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TRAINING FOREIGN STUDENTS IN AGRICULTURAL ECONOMICS

Chairman: Mervin G. Smith, Ohio State University

TEN YEARS OF FAO STATISTICS AND ECONOMICS TRAINING CENTERS

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Food and Agricultural Organization, UN

FAO—the Food and Agriculture Organization of the United Nations—took over from the International Institute of Agriculture the task of assembling and publishing statistical and economic information on world agriculture. From the beginning, at the Hot Springs conference and in drafting its basic constitution, the founders of FAO recognized that its task would go beyond merely compiling information. FAO was also to assist member countries to collect more reliable and comprehensive data and to analyze and use that information for the wiser planning and development of their food and agricultural policies. Improvement of the methods was especially stressed for the less developed regions, Asia, Africa, and Latin America. This assistance includes providing forums for reaching decisions on what problems to attack and what policies to follow in attacking them, as agreed in international meetings of country representatives. Assistance also includes direct aid by the FAO staff in carrying these agreements into action. The staff assistance includes the preparation and issuance of general suggestions for carrying out specific undertakings—such as the minimum coverage, schedules and methods of collection and tabulation for the 1960 World Census of Agriculture—and also direct help in the country itself, by FAO staff members. Since the inauguration of the United Nations Expanded Technical Assistance Program (ETAP) in 1950, the agricultural sector of which is handled by FAO, direct technical assistance to individual countries has been greatly expanded.

In the FAO staff, work on agricultural statistics and economics is con-

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ducted in the Economics Division. Very early in that work, it was recognized that underdeveloped countries were underdeveloped not only in their transportation, communications, industry, and agriculture, but also in the education and training of their people, in their educational and extension systems with which to improve their training, and in their knowledge and skill in organization and administration. National programs for economic development therefore need to include provision not only for the physical development of the country but also for training the people to provide the skilled manpower. This includes training for workers on farms and in factories, in semiskilled and supervisory positions, and in professional, technical, managerial, and administrative positions and occupations. Although warehouses, factories and roads can be planned and built in a year or two, and even irrigation or hydroelectric projects in a few years, the development of trained and skilled manpower—and of the institutions and the teachers to train them—may take a generation or more.

The need for a long-time and comprehensive attack on the training of agricultural personnel was emphasized in all the country studies conducted by FAO in its early years,[1] and in the resolutions of FAO annual conferences and special technical meetings.

People in FAO soon realized, however, that much quicker-acting methods were necessary if the level of existing professional workers in the less-developed countries was to be brought up nearer to that in other countries within a reasonably short space of time. Fellowships awarded for study abroad offer one solution; and these have been provided to a considerable extent, both by local governments, FAO, and other agencies. Fellowships have been awarded by FAO for many students to study in advanced countries, usually for 6 to 12 months. Many of these have been in statistics and agricultural economics. This paper will not review the size or effectiveness of the FAO fellowship program.

Study abroad, however, requires a knowledge of a foreign language, usually English; and a longer stay away from the home country than is possible for officials carrying important professional or administrative responsibilities. To meet these difficulties, FAO began very early to develop special international training centers, located right in the region concerned. These were really *ad-hoc* graduate schools of 1½ to 4 months duration. Originally organized to give training in modern methods of collecting and compiling agricultural and livestock statistics, both by census and crop-estimating methods, training centers have also been used in later years to provide training in other economic and statistical topics of concern to agriculture, including the formulation and cost-and-benefit appraisal of economic development projects; the use of objective sampling

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[1] See report of the FAO missions to Greece, Thailand, and Poland, 1947 and 1948.

techniques in the collection of statistics; marketing problems and facilities; the design of experiments; and most recently, the use of economic and statistical analysis in general agricultural economic research.

A list of all 24 such training centers conducted by FAO is given as Appendix A, together with a bibliography of reports issued. The number of participants attending, countries represented, and regular-course faculty and other lecturers is also shown for each center. The duration of each center is shown in Figure 1, by years, together with the type of training (white for statistics, cross-hatched for economics and marketing, and national centers starred).

Each international training center was organized in cooperation with a host government, which provided meeting facilities and other local arrangements at its own cost. Other interested international organizations participated either as co-sponsors or as cooperators in most cases, and joined in providing the teaching staff of internationally-recognized experts. Agencies providing such co-sponsorship and cooperation include the U.N. Statistical Office, Economic Department, and regional commissions; UNESCO; the International Bank; the International Statistical Institute; the Inter-American Statistical Institute; the ILO; WHO; the Commission for Technical Cooperation in Africa South of the Sahara; European statistical offices, mostly in the U.K. and France; the U.S. Census Bureau and the Bureau of Agricultural Economics; IBM and Remington Rand corporations; Iowa Agricultural College and Florida Agricultural College; etc.

Each center is organized to cater to the requirements and level of development of the professional workers in a given region, such as the Near East, the Far East, Latin America, Equatorial Africa, or Central America. A few centers have been organized for Europe. In each case, countries and territories in the region concerned are invited to designate a limited number of workers to take the training. These are preferably persons already doing responsible governmental or institutional work in the fields involved, or else promising advanced students in those fields. At the Center, all "participants" are treated alike. (The words "student" or "trainee" are barred as too derogatory to the dignity of professional men already established in their own countries, while "delegate" or "representative" is similarly undesirable as that might encourage the passing of resolutions!). Training is given through lectures or discussions by the international staff of established experts; practical laboratory or workshop periods; visits to governmental and private statistical offices; and field experience in conducting actual statistical surveys, appraising a development project, etc. Discussion and debate are encouraged, and many special seminars and other *ad-hoc* meetings are arranged. Usually some form of certificate of attendance is given at the end of the training, and sometimes academic grades attained are also shown.

FAO TRAINING CENTERS IN STATISTICS AND ECONOMICS
Location and duration by years
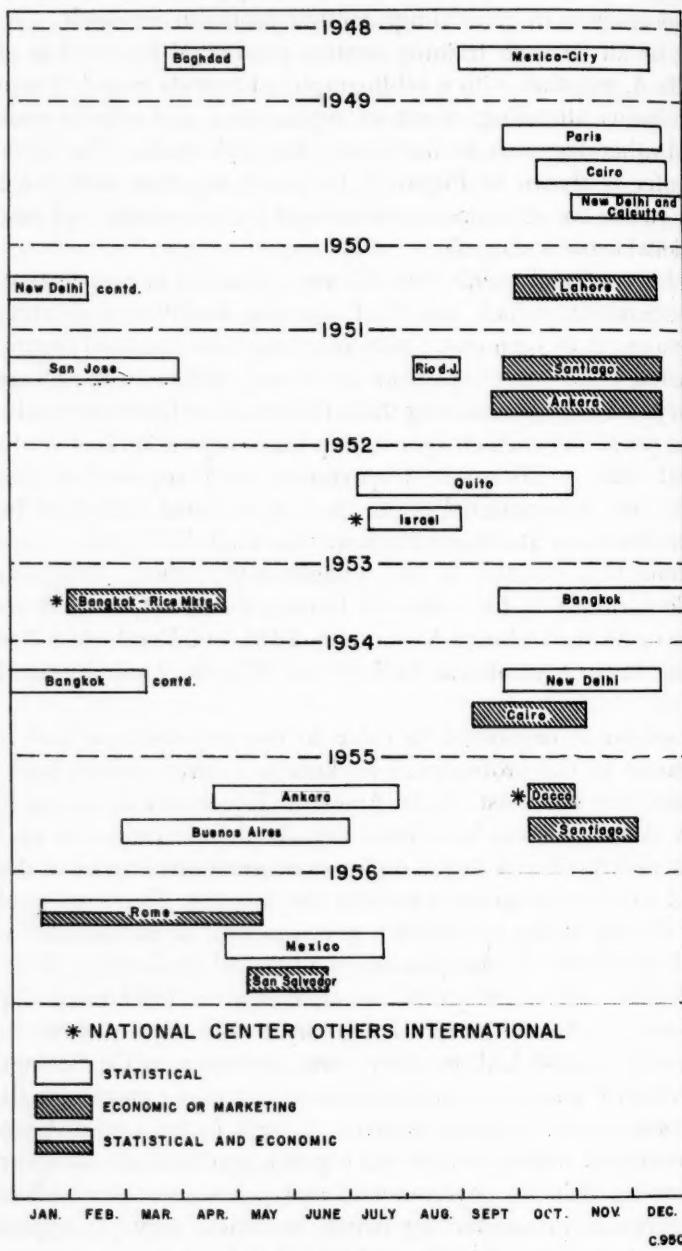
FIG. 1

Evolution and Coverage of the Training Centers

In the beginning, the centers were concerned primarily with the collection of basic agricultural statistics, either through censuses or through crop and livestock estimates. Besides covering the basic statistical theory, and methods and administration, supplementary training was given in the kinds and uses of agricultural statistics. All of the early centers (1948 and 1949) were of this type. In each case a sample census or field survey was planned, organized, and conducted by the participants as part of that training. Beginning with the New Delhi Center of late 1949, more attention began to be paid to the scientific use of sampling techniques, and to the objective measurement of yields. The long (six months) training center at Bangkok in 1953-54 was of this type, and included a full-scale field demonstration project planned and conducted by the participants, including preparing the frame for the sample. From 1948 to date, 12 international statistical collection training centers were conducted: two in the Far East, three in the Near East, one in Africa, one in Europe, and five in Latin America, serving about 480 participants in all, plus a national center in Israel for 1947.

Beginning in 1950, attention was also directed to economic issues, especially in financing economic development. Following statements by the President of the International Bank that the Bank had more money than it could loan, because of the lack of suitable projects, training centers were organized on the preparation of development projects, and on their cost and benefit appraisal. Both the Bank and the U.N. cooperated in staffing these centers. During 1950 and 1951 such training given in three centers (at Lehore, Ankara, and Santiago) provided for 161 participants from the Far East, the Mediterranean Basin, and Latin America, coming from 43 different countries. Later, in 1954, a similar center was conducted at Cairo, serving 40 participants from six Near Eastern countries, plus a brief one-month national center at Dacca, in 1955, for 28 participants from East Pakistan.

One intensive national marketing center, dealing with rice sampling, grading, and storage, was given at Bangkok in 1953, for 53 Thai nationals; and an international center on livestocks and meat marketing at Santiago, Chile, was given in 1955 for 28 participants from seven South American countries (Uruguay, Paraguay, Chile, Bolivia, Peru, Ecuador, and Venezuela).

At the center for livestock and meat marketing, the training included (1) lectures on the economic phases of marketing, the technical operations of slaughtering plants, processing plants and refrigerated warehouses; (2) field trips to visit and observe marketing, slaughtering and meal processing facilities; and (3) country seminars by the participants.

In cooperation with the FAO Agriculture Division, two training centers

on methods of organizing agricultural credit; three on problems of agrarian reform, and one on methods of financing agricultural development, were conducted since 1950, serving a total of 187 participants. These are not included in the detailed listing and chart.

Attention has also been given to the application of statistical methods to the design of agricultural experiments and to the use of farm surveys to verify the effectiveness of experimental results under practical farm conditions. The first center on this subject, held at New Delhi in 1954, served 36 participants from 12 Far Eastern countries, and had an especially strong faculty—eight course lecturers and 19 special lecturers on varied subjects. Further training of this type was given in 1956 at Mexico City, in a center for 30 participants from five Central American countries.

The most recent new development was the Rome Center for Agricultural Economics and Statistics, conducted for four months, from mid-January through mid-May 1956. This Center was established especially to serve European countries. The methods of research common in North America in such subjects as price analysis, marketing, agricultural development planning, and the use of advanced statistical analysis in these and other agricultural economic fields, are relatively little known or used in Europe, while much of European crop estimates are based on annual censuses or on "opinion" surveys rather than samples employing objective measurements. The Rome Center attempted to give in four months the most essential courses that would be covered in an academic year's work for a master's degree in agricultural economics in a standard American graduate school. Two sets of courses were offered, one for agricultural economists, and one for agricultural statisticians. Although few scholarships could be provided, the Center was well attended. It served 38 participants outside FAO from 12 countries, and 58 FAO staff members took a limited number of courses.

Although, training was given to about 900 participants in these various types of centers, in the fields of economics and statistics, organized by the Economics Division.

Problems in Operating International Training Centers

Although each center had its own distinctive character and aspects, certain problems are common to all. These will be commented on briefly.

Language. Ideally, all training centers should be conducted in the language of the participants. That involves two difficulties—the participants may speak two or more languages (English, French, and Dutch, in the Far East, or Arabic, French and English in the Near East); and it may be difficult or impossible to find qualified experts who can lecture in the languages desired. This difficulty has been dealt with in various ways —operating the center in several language sections, with different groups

of lecturers for each; (used in the Cairo Project Appraisal Center, and the African Statistical Center); or trying to get participants with a familiarity with one language (usually English or French), and following the lectures with a brief summary in the most prevalent local language (used often for Arabic in the Near East); using interpreters with simultaneous or consecutive interpretation; or passing out outlines, abstracts, or texts of the lectures ahead of time, so that participants can follow while the lecturer is talking.

Using different language sections is the most satisfactory method, but also is expensive and is limited by the availability of qualified lecturers. (For example, at the Ankara Sampling Center in 1955, it took a staff of 14 lecturers to service 40 participants in separate French, English, and Turkish sections.) Simultaneous interpretation is expensive in men and equipment, requires extraordinarily skilled interpreters, and has rarely been used. Consecutive interpretation (as from English into Spanish at Mexico) is slow, interrupts the give and take of discussion, and has proved rather unsatisfactory where tried. The other methods all have similar advantages or disadvantages. At the Rome four-month Center, where English with mimeographed lecture abstracts were used, participants helped each other within country groups, and all developed passable ability to read, speak, and write English before the course was completed. No ideal method exists; each center must choose in view of existing conditions of personnel and resources.

Financing. The earliest centers were financed directly by the regular FAO staff and budget, and by the contributions, in kind and in cash, of the host government and of other cooperating agencies. Since late 1950, funds from the U.N. Expanded Technical Assistance Program have helped expand the volume of work that could be conducted. Pressure on these funds is very great, however, and the Economics Division can now finance and conduct only about half the training centers that member nations currently wish us to conduct. The ambitious four-month Rome Center of 1956 was conducted entirely with staff and facilities squeezed out of regular program activities and with overwork by key staff members, plus small contributions from the Italian Government, the University of Rome, and the International Statistical Institute. This effort cannot be continued, however, unless outside foundation funds are obtained for the purpose, and prospects for this do not currently seem bright.

Faculties and lecturers. Faculties usually include full-time teachers who conduct one or more courses of lectures and seminars each, plus special lecturers who give a few lectures on related subjects (these latter help to use in the teaching staff national or regional experts whose competence is not adequate to handle a whole course). The numbers vary widely—from as few as four full-time teachers and ten lecturers at the first Cairo Statis-

tical Center, and usually not more than five to seven full-course lecturers, to as many as eight course teachers and 14 special lecturers (on the many technological issues involved) at the first center on Experimental Design at New Delhi. In general, it is best to hold the number to the minimum needed to cover the field, to prevent too great dispersion of effort and attention. Of course it goes without saying that established mature scholars, who have used the methods in actual work and can speak and teach with assurance, who command interest and respect, and who have had some prior experience outside their own country, are essential for the course lectures. Where young theorists with little practical experience or field experience have been tried, their courses have not been satisfactory. As examples of the caliber of men who have served successfully as course lecturers for FAO Centers, one might mention Emil de Vries, Dutch economist of the International Bank and now head of the new Institute of Social Studies; Hans Singer of the U.N.; Lund of the International Bank; George Mehren of the University of California; and in Statistics, Hans Staehle and Marion Clawson, Morris H. Hansen, W. F. Callandar, J. Neyman, M. G. Kendall, V. G. Panse, and P. S. Lokanothan, plus many experienced members of FAO's own staff, including Howard R. Tolley, R. V. Sukhatme, Professor Vittorio Marrama of Italy (formerly a Bank staff member), and Felix Rosenfeld (the latter's ability to lecture both in French and English has helped materially in making several bilingual centers possible). The need to arrange for the staff far enough ahead so the lecturers can be announced well in advance to prospective participants, and the difficulty of prying top-rank professors loose from their jobs for substantial periods of time, makes the recruitment of staff one of the real headaches in conducting this work.

The best content of the course-work at each type training center is also a large and complicated problem, which I will not go into here. The published reports of the several centers give full information on this, and provide a basis for studying its evolution (Appendix B).

Participants. Getting a proper group of participants to attend the center is also one of the most difficult problems. General prerequisites are stated—college graduation in one of the related fields, plus responsible experience, and if possible present employment in responsible governmental or institutional employment, or in corresponding private employment; or work as an especially promising graduate student; and also adequate knowledge of one of the languages to be used. Despite all the advance effort, lecturers at international centers invariably bemoan the fact of the enormous dispersion in age, qualifications, activities, and interests of the participants—ages often extending from 25 or less to 55 or higher, and training from a bare college graduation in economics or agriculture to Ph.D.'s and heads of research or administrative staff units.

Many devices have been used to deal with this wide dispersion, such as providing refresher courses for those deficient in mathematics or basic economics (and sometimes even in simple arithmetic); splitting the lectures and classes in statistics centers into elementary and advanced sections (the latter including those with reasonable preparation in mathematics and elementary statistics); or giving special tutoring to especially backward participants. The remedy often urged by lecturers—excluding improperly qualified participants altogether—simply is impossible because there are very few fully qualified men in the underdeveloped countries. International training must start with improving the ability of the men who are there and who are doing the jobs, and cannot wait for some ideal set of qualifications to be fulfilled. Unless we take the possible participants as they are, and do the best we can to raise their abilities and widen their vision, we would not have any body of participants at all from most underdeveloped countries.

The fact that a large part of the participants are public officials, receiving government salaries while attending, and going back to their regular posts when the training is finished, adds seriousness and strength to their work at the center, however.

Recruiting a satisfactory enrollment of reasonably qualified participants is itself a second great difficulty. Qualified and responsible men are few and busy in underdeveloped countries; demands on them to attend meetings and conferences are many; and it is difficult to get them released for the two to four months' duration of the typical center. Further, the written invitation to the government to designate or recruit participants may be held up for months in the Foreign Ministry or on the wrong desk, and may never reach those really interested. In practice it has often been found necessary to have someone visit individually the countries in the region to make sure the invitations have gotten through to those concerned, to encourage and, if desired, to assist the heads in finding and selecting people for the training. Despite the acute need for the training, such field canvassing and preparation is often an essential part of securing an adequate student body. This difficulty of recruiting participants also explains why some centers have been limited to four weeks or two months, while three months or even four are better from the educational point of view. Fellowships to cover subsistence costs of the participants from outside the host city, and half their travel costs, are also provided wherever possible from the ETAP funds. Even in Europe, several highly developed countries said they could not send participants to the recent Rome Center because of the lack of international fellowships, or of available domestic funds to finance them.

Field work and field projects. Since the first major statistical center in Mexico, trying out the methods in practical field projects has been an

integral part of the work in almost every center, as previously mentioned. This has served the double purpose of translating theoretical ideas to actual operating programs of sample surveys, censuses, or project appraisals, and of getting professional people who often had never been out of their capital city or their sheltered office or laboratory, out into the field, with its mud, dust, suffering, and masses of struggling yet earnest common people. Too often officials in underdeveloped countries have taken over the mores of their previous colonial administrators—that a gentleman never gets his hands or his boots dirty, and never does any manual work that a peon or fellaheen can do for him. To see their highly respected professors out measuring off plots and harvesting and weighing samples with their own hands, or to hear them discussing the effect of water and fertilizers on yields with simple farmers, often is an eye-opener in creating more active ideas of sharing in life and work on the part of the participants. In both these objectives, effective field demonstration projects, explored and prepared in advance before the daily treadmill of lectures gets underway, are an essential part of every international training center. Such field work, with its application of the theories to secure practical results under conditions of literacy, administrative competence, and agricultural conditions not too different from those in their home countries, serves far better to teach the participants how to apply what they have learned at home, than does observation or participation in such activities under the vastly different conditions of a highly developed country with mores, literacy, technical knowledge, administrative and technical skill, and wealth, a generation or even a century ahead of those in their home countries.

Facilities. Many arrangements must be prepared in advance. These include providing essential calculating machines or other equipment; organization of textbooks and a reference library (the publications of international organizations, reports of previous centers, and other basic documents, generally are almost completely unknown to those who come as participants); arrangements for classrooms, lecture halls, and laboratories, office space for staff and faculty, and housing for faculty and participants. Attention must also be given to recruitment and training of administrative and clerical staff, provision of office equipment, furniture, and supplies, and provision of athletic facilities and of recreational possibilities. Usually it is found best to have a qualified local person, familiar with local customs, hotels, and rules and regulations, serve as secretary or general manager, to take as much as possible of the administrative burdens off the shoulders of the foreign lecturers and academic director. Often it is helpful to set up very early a mixed domestic-international steering committee, with representatives from all the domestic ministries and agencies involved, and of all the cooperating international institutions as they

arrive, to canvass problems and difficulties and to find ways of solving them.

When a large building can be obtained where all the participants and faculty can live and eat together, and where the offices and meeting halls can all be in the same building or in some other convenient building, that provides almost ideal conditions for the development of friendship among faculty and participants, and for informal discussions and interchange of ideas. Similarly, the centers are most successful when they are held, not in a capital center with men coming part time from their work, and with lecturers and participants scattered through many hotels and boarding houses, but where all reside in some institution in a rather small town— such as at an agricultural college or research center equipped with student housing ("hostels" in the Far East). Then both faculty and participants can give full attention and interest to the work at hand, free of the pressures of their regular work, and of the distractions of a great metropolis.

Stimulus to other technical activities. Conducting training centers has not only raised the level of participants, but also has broadened the knowledge and ability of lecturers. Lecturers and experts have to learn how to adapt their experience and knowledge to the economic and social backgrounds of participants from underdeveloped countries. Preparation for training centers often leads to new collection of important information. For example a large part of the information on the status of the use of experimental designs in agriculture was collected at the experimental design training centers in New Delhi and Mexico. Similarly the status of the uses of sampling in censuses, the methods by which the various difficulties experienced by the countries in improving their statistics are overcome, etc., was discussed in the course of the seminars held at these training centers. Training centers provide opportunities for exchanging mutual experience, assessing the status of respective statistics, and standardising the methods applicable to regions as a whole. The technical knowledge of the lecturers themselves thus benefits from the interchange of ideas with participants and other lecturers. One danger, already apparent in some cases, is that some graduates may feel that they know all that there is to know about the subject and do not need more training or study in the field covered by the center. We must recognize this danger, and be careful in such training centers to emphasize that they have had only an introduction to the subject and to give them some concrete understanding of how much more remains for them to study, know, and understand.

Training centers are also a powerful way of raising the interest of governments in a field of activity. Sometimes the participants themselves undertake some work in their field of training upon return to their coun-

tries; or sometimes they initiate a request for technical assistance for their home countries, so that training centers are generally followed by a series of requests for Technical Assistance experts. Another development that has often occurred in the past is the selection of the best participants for fellowships abroad. In almost all countries ex-participants in FAO training centers form a class of technicians ready to cooperate in FAO activities and to facilitate the work of FAO regional and headquarters officers, either in replying to current correspondence or on the occasion of their visits. Thus even in cases where the educational level of the participants does not enable them fully to assimilate the technical program of the center, the experience helps to open the way for further assistance to the country and for its better cooperation in international activities. In a number of countries the statistical collection methods have been reorganized along the lines taught at the training centers, by earlier participants, in cooperation with FAO statistical experts assigned to that country. The statistical design of experiments has been introduced by participants into many countries where these methods were previously unknown. In several countries previous participants from economic project appraisal and agricultural programming training centers have taken the lead in drawing up the first national programs for agricultural development.

Follow-up. For a few centers, the careers of participants have been followed for a few years subsequently, by questionnaires to them and to their governments. These inquiries have shown that nearly all have applied in their own countries the knowledge gained, and that half of the participants replying have been promoted to more important work and positions during the year or two following the center, usually in the fields for which the training was provided. At the end of each training center, the gratitude and thanks of the participants for the new knowledge and vision they have attained has been almost embarrassing. We see an increasing number of familiar faces, from past participants, coming as governmental representatives to FAO technical meetings or conferences. These indications make us feel that these efforts have been worth while and have helped contribute, along with the work of national institutions and other international or bilateral activities, to the gradual progress in knowledge, competence, productivity, and agricultural development in the less-developed countries.

Short-period training centers can serve as refreshers for people already trained or as an introduction to the subject for those without specialized training. They cannot, however, take the place of adequate undergraduate training, and that is the great shortcoming in most underdeveloped countries. This is especially marked in the field of agricultural economics and statistics. In a trip just completed to 14 Latin American countries and territories, I did not find a single agricultural college with a specialized

degree in agricultural economics, or with any courses offered at all in marketing, production economics, land classification, price analysis, economic statistics, etc. Elementary farm management and very elementary agricultural policy are all that are given in the best colleges. Much the same situation exists in Asia and Africa and even in most countries of Europe.

Efforts to correct this situation are underway, however, and in a number of schools plans are under discussion to enlarge the work in this field, and in a few cases, to offer an undergraduate specialization in agricultural economics. Improvement of the basic undergraduate work in agricultural economics and statistics still remains the great need in most countries of the world.

This account has been necessarily brief, and perhaps rambling in its approach. I hope it will convey some idea of developments in this important field, and something of the color and texture of the problems, headaches, and joys of setting up and carrying through an *ad-hoc* international graduate school for a brief period. Perhaps this review of the progress and problems may also interest some of those who control the sources of funds, public, private, or eleemosynary, to provide the wherewithal to develop more fully this important work.

APPENDIX A

List of FAO Training Centers in Agricultural Economics and Statistics

Year	City	Region	Duration	No. of participants	No. of countries represented	Full-course teachers	Other lecturers
Statistical Collection and Sampling Centers							
1948	Bagdad	N.E.	25 Mar.–3 May (1½ mo.)	40	4	1	—
1948	Mexico	L.A.	2 Sept.–10 Dec. (3+ mo.)	60	16	15	15
1949	Paris	Europe	26 Sept.–20 Dec. (3 mo.)	40	10	—	24
1949	Cairo	N.E.	10 Oct.–22 Dec. (2½ mo.)	33	5	4	10
1949–50	New Delhi & Calcutta	F.E.	1 Nov.–10 Feb. (3 mo.)	56	9	5	28
1951	Rio de Janeiro	L.A.	6 Aug.–31 Aug. (3 wks.)	13	9	5	8
1951	San Jose	L.A.	6 Nov.–Feb., 1951 (3 mo.)	28	13	3	5
1952	Quito	L.A.	7 Jul.–29 Oct. (4 mo.)	60	11		18
1953	Ibadan, Nigeria	Africa	1 Jul.–5 Sept. (10 wks.)	42		14	5
1953–54	Bangkok	F.E.	22 Sept.–11 Mar. (6 mo.)	40	11		7
1955	Ankara	Medit.	18 Apr.–28 Jul. (3 mo.)	30	10	14	3
1955	Buenos Aires	L.A.	7 Mar.–29 Jun. (3 mo.)	39	11	4	10
Experimental Design and Survey Techniques of Experimentation							
1953	Israel	Nat.	Jul. & Aug. 1952 (6 wks.)	44	1	2	
1954	New Delhi	F.E.	20 Sept.–18 Dec. (3 mo.)	36	12	8	19
1956	Mexico	C.A.	23 Apr.–20 Jul. (3 mo.)	30	5	3	2
Economic and Marketing Centers							
1950	Lahore	F.E.	2 Oct.–15 Dec. (2½ mo.)	54	8	7	19
1951	Santiago	L.A.	26 Sept.–20 Dec. (3 mo.)	67	19	7	15
1951	Ankara	Medit.	1 Oct.–20 Dec. (3 mo.)	65	11	6	26
1953	Bangkok	*Thai.	2 Feb.–25 Apr. (3 mo.)	53	1	5	
1954	Cairo	N.E.	6 Sept.–11 Nov. (2 mo.)	40	6	6	23
1955	Dacca	*Pakist.	4–29 Oct. (1 mo.)	28	1	5	7
1955	Santiago (meat mktg.)	L.A.	3 Oct.–12 Nov. (6 wks.)	28	7	5	4
1956	San Salvador	L.A.	7 May–9 Jun. (1 mo.)	17	7	7	4
1956	Rome	Europe & India	16 Jan.–12 May (4 mo.)	38 full-time 58 part-time	12	6	20

Title of Report	Report No.
Report to the Government of Israel on the Seminar in Experimental Design	FAO Report No. 75
Report on Far Eastern Demonstration Center for Agricultural Statistical Sampling, Bangkok, September 1952–March 1953	FAO Report No. 137
Report to the Government of Thailand on the National Training Centre on the Grading and Inspection of Rice and the Economics of Rice Storage Operations, Bangkhen, Thailand, 2 February–25 April 1953	FAO Report No. 197
Report of The African Training Centre in Agricultural Statistics, Ibaden, Nigeria, July–September 1953	FAO Report No. 198
Second Latin American Center for Training and Demonstration in Agricultural Statistics, Quito, Ecuador, July 1 to October 29, 1952—Notes, Observations and Recommendations by R. L. Gillett, Lecturer on Agricultural Estimating	
Informe sobre el Centro Latino-Americano de Capacitacion y Demostracion Estadistica Agricola, Quito, Ecuador, Junio–Septiembre 1952	FAO/ETAP No. 332
Report on the Arab Training Centre on The Economic and Financial Appraisal of Agricultural Plans and Projects, Cairo, Egypt, September–November 1954	FAO Report No. 352
Report on the International Training Centre for Southeast Asia and the Near East on Experimental Designs and Survey Techniques of Experimentation, New Delhi, India, September–December 1954	FAO Report No. 362
Report on the Pakistan National Training Centre on the Economic and Financial Appraisal of Agricultural Plans and Projects, Dacca, East Pakistan, 4–29 October 1955	FAO Report No. 437
Report on the Demonstration Centre on Agricultural Sampling Surveys for the Mediterranean Region, Ankara, Turkey, 18 April–28 July 1955	FAO Report No. 450
Draft Report of Training Institute on Economic Appraisal of Development Projects, Ankara, Turkey, 1 October–20 December 1951 (One photostatic copy only available)	
Memoria—Laboratorio de Tabulacion Censal, Rio de Janeiro, D.F., Brasil, Agosto de 1951	
Report on the Asian Centre on Agricultural and Allied Projects, Lahore, Pakistan, 2 October–15 December 1950	UN Series A. No. 1
Report on the International Training Centre on Censuses and Statistics for Southeast Asia and Oceania, New Delhi and Calcutta, India, November 1949–February 1950	UN Series M, No. 7
Report on the International Training Centre on Statistics and Censuses for the Near East Countries, Cairo Egypt, 10 October–22 December 1949	UN Series M, No. 6
Report on the European Centre of Applied Agricultural and Demographic Statistics, Paris, France, 26 September to 20 December 1949	UN Series M, No. 5
Report on the First Latin American Training Centre on Statistics and Censuses, Mexico D.F., Mexico, 2 September to 10 December 1948	UN Series M, No. 2
Informe Sobre El Centro Latinoamericano de Capacitacion en Planes y Proyectos Agropecuarios y Materials Conexas, Santiago de Chile, 26 de Septiembre al 20 de Diciembre de 1951	FAO No. FAO/53/7/5384
(Typed copy) First Draft of Report on the Latin American Training Center on Agricultural and Allied Plans and Projects, Santiago, Chile, 26 September–20 December 1951	
Article, Training in Economic Appraisal for Development Projects, FAO Monthly Bulletin of Economics and Statistics, Vol. 1, No. 3, July 1952, pp. 2–6	
Draft Report of the Latin American Demonstration Center on Agricultural Sampling Techniques	
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U.S. TRAINING FOR FOREIGN STUDENTS IN AGRICULTURAL ECONOMICS

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THIS is an attempt to state the problems faced by American colleges and universities in training foreign students in Agricultural Economics. The statement is concerned principally with the problems of teaching in the institutions in this country. However, I have found it necessary to give some consideration to supplementary or coordinate teaching and research overseas, in recognition of the international nature of the problems. Throughout, I have attempted to consider the problem especially in relation to what are currently called the underdeveloped areas. This is where our difficulties center.

In the opening paragraphs, I have attempted to put our on-campus teaching activities in perspective, against a background of some general statistics compiled by the Institute of International Education and the International Cooperation Administration. From the latter I have been able to get some fairly detailed information regarding the participants in their programs specializing in agricultural economics. I have tried to keep my bother to colleagues in the teaching institutions at a minimum, partly because they were circularized on this subject last year, and partly because I anticipate that something more systematic and comprehensive than a paper such as this is needed on the subject and will eventually be forthcoming. I did inquire from a number of institutions for the names of persons from the so-called underdeveloped areas who have completed the Ph.D. degree since 1945 and have returned home. I have written to these people and the schedules received have been drawn upon for this statement, but the returns were not complete at the time of writing. Professor Case has been most helpful in his capacity of chairman of the committee which reported on a similar subject to the meetings last August. However, taken as a whole, the facts needed to consider this problem adequately are not easily available—and I did not succeed in garnering many of them. Consequently, the paper is mostly an attempt at interpretation based upon my own experience—out of which I venture to define the critical issues.

I

There is no general record, it seems, of the number of foreign students studying agricultural economics in the United States. The Institute of International Education does however have a remarkable record of foreign students in American colleges and universities. For recent years they have a record of the academic status of students and their general field of

specialization by the countries from which they come. In this record students in all fields of specialization within economics, including agricultural economics, are listed as students in economics. Even so, I found the study of these statistics to be very rewarding.

There were 36,494 foreign students studying in American colleges and universities in 1955-56. This number has steadily increased since the war. For 1923-24, the first year of record, the Institute reported 6,739 foreign students studying in U.S. educational institutions. It was a bit higher during the 1930's but was 6,154 in 1939-40. In 1946-47 the number reached 14,942 and has climbed steadily to the present figure—which is roughly six times the prewar figure. A recent estimate attributed to President Holland of the Institute of International Education placed the current enrollment of foreign students at 38,000, or 1½% of all students in American colleges and universities.

In 1955-56, 46% of the foreign students came from Africa, the Middle East and Asia. Another 23% came from Latin America. Thus about 70% of the foreign students came from these areas. Stated differently, 30% of the foreign students in this country in 1955-56 came from Europe, Canada, Australia and New Zealand. It is interesting that the proportion of students from these latter countries is slightly higher now than in 1923-24. In that year almost precisely one half of the foreign students came from the Far Eastern countries; the proportions of students from different major areas of the world have changed very little over a span of 32 years.

The source of financial support for foreign students is also interesting. In 1955-56 the overwhelming majority of foreign students in the U.S. were either self supporting or had private funds for support. Fifty-four percent are reported as self supporting; another 32%, privately supported. U.S. government support accounted for 6% of the total, while foreign government support was almost as great, 5%. Between two and three times as many students from Africa and the Middle East were supported by foreign governments as by our own. In summary, out of the more than 36,000 foreign students studying in the U.S. in 1955-56 only 1,797 were being supported by our U.S. government programs, while nine times as many foreign students were being supported by their own efforts, or that of their families.

Almost three fifths of the foreign students in 1955-56 were undergraduates (58%); with about two fifths (38%) registered as graduate students. The proportions seem to reflect, country by country, the stage of development of collegiate institutions. Students from India and Egypt, for example, are predominantly graduate students, while from some of the other countries in the same regions the students are predominantly undergraduates.

We come a bit closer to our field of special interest by noting the fact that about 4% of the foreign students studying in the U.S. in 1955-56 were specializing in economics, i.e. 1,361—a figure almost identical with the number specializing in agriculture, 1,354. The number of economics students has increased steadily during the past three years for which data are available; in 1953-54 there were 1,034. There was of course considerable variation among the percentages country by country—but the 4% seems to be a fair guide. Three percent of the students from Latin America are specializing in economics; 4% from Europe and the Middle East; 5% from Africa and the Far East. Taken altogether 1,029 students specializing in economics came from the so called underdeveloped areas. There is no way of estimating how many are graduate students. Among all students the percentage of graduates is about 40%—for economics it might be higher; but it is doubtful whether more than 60% of them are graduates —perhaps 600.

So much for the general picture. I turn now to observations on the Land Grant College System.[1] This comes a bit nearer home for most of us. In 1955-56, 21% of the foreign students in the U.S. were enrolled in the Land Grant institutions. Here the proportion of graduate students is higher than for the aggregate in the U.S. Fifty-three percent of the foreign students in the Land Grant institutions were registered graduate students. In rough proportions this is slightly more than one half in comparison to slightly less than two fifths for all institutions. Stated differently, 17% of all undergraduate students from other countries are enrolled in the Land Grant institutions while 29% of all foreign graduate students were so enrolled.

This is as near as I have come to providing a general statistical setting, in terms of foreign student populations, for the consideration of the problem of the teaching of foreign students in agricultural economics in the U.S. The staff of the International Cooperation Administration, however, did provide us with a detailed tabulation of the participants in their trainee program who have specialized in agricultural economics since 1949. (This total includes at least some of the participants sponsored by the foreign-aid programs who have attended short conferences.)

Inasmuch as these are unpublished figures especially compiled for this occasion I am presenting a summary table of them.

The ICA has sponsored 658 participants with special interests in agricultural economics since 1949, a period of almost eight years. Of these some 60% (415) were sponsored for less than six months—the remainder for longer periods. The general policy is, I believe, to limit sponsorship to

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[1] For the listing of Land Grant institutions, see Agr. Handbook No. 95, 1955-56, U.S.D.A., A.R.S., March 1956.

TABLE 1. AGRICULTURAL ECONOMICS PARTICIPANTS UNDER ICA SPONSORSHIP, 1949 TO OCTOBER 1, 1956

By Region of Origin	By Fields of Specialization Within Agricultural Economics								
	Genl. Ag. Econ.	Land Tenure	Agr. Marketing	Agr. Credit	Agr. Statistics	Commodity Marketing	Farm Management	Agr. Cooperation	Total
For less than 6 months									
Far East	10	6	2	47	2	—	—	11	78
Near & Middle East	5	—	3	8	1	4	1	4	26
Africa	—	2	—	—	1	—	—	3	6
Europe	28	—	32	49	6	50	72	19	256
Latin America	3	2	1	36	1	—	2	4	49
Total	46	10	38	140	11	54	75	41	415
Other than Europe	18	10	6	99	5	4	3	22	159
For 6 months and more									
Far East	12	16	4	20	22	3	3	29	109
Near & Middle East	8	3	1	5	12	4	5	8	46
Africa	1	—	—	—	—	—	—	—	1
Europe	11	8	—	8	10	—	6	—	43
Latin America	15	—	—	10	11	—	5	3	44
Total	47	27	5	43	55	7	19	40	243
Other than Europe	36	19	5	35	45	7	13	40	200

periods of one year or less. The participants sponsored for the shorter and the longer periods very likely have different needs when on college campuses. The shorter-term people, I would suppose, are more likely to be older and perhaps distinguished scholars or officials. They are likely to want to consult with specified persons known to them by professional reputation. It is however the participants with a program for six months or more who are most likely to be assimilated to our graduate teaching program.

Although the primary focus of this paper is upon the problems of the teaching of agricultural economics to students from the less developed areas, some comparison with the programs of European and non-European participants is of interest. Slightly less than half (46%) of the total number of ICA participants specializing in agricultural economics came from European countries. Eighty-six percent of the Europeans were sponsored for periods of less than six months; and of these, 60% were interested either in marketing or farm management. Although we do not have the time distribution of their participation, very probably the Europeans came in the early years of this period 1949 and 1950, as a part of the ECA program of assisting in the postwar reconstruction of Europe.

The majority of the ICA trainees, however, 54%, have come from non-European areas. Unlike the Europeans, most of these (55%) had programs of six months or more—and very probably most of these have had one year programs. Also, the longer-term, ICA trainee appointments have been awarded principally to students from the so-called underdeveloped

areas. Of the 243 appointments of six months or more since 1949, 200 (i.e. 82%) have gone to persons from non-European areas. Slightly more than half of these have come from the Far East, one fourth from the Middle East, and one fourth from Latin America. These students have been interested principally in agricultural statistics, general agricultural economics, agricultural credit and agricultural cooperatives. A considerable number of the students from the Far East particularly have been interested in land tenure. Taken as a whole the ICA trainees from the underdeveloped areas have been interested in those aspects of agricultural economics most directly concerned with public administration (statistics and general agricultural economics) and the structure or basic social organization of the agricultural economy—credit facilities, cooperatives and land tenure.

From such meager data one may draw a few suggestions concerning the future. It seems to me to be significant that the total enrollment of foreign students in the U.S. continues to increase, year after year. I find it interesting also that such a small percentage of the students are supported directly by government funds—roughly one in 10, when U.S. and foreign government support is combined. The number of ICA participants from the so-called underdeveloped areas I found to be surprisingly small. Only 200 trainees from these areas have been given appointments of more than six months since the inception of the program—if spread out over only four or five years this is but 40 to 50 per year. The number is so small in relation to needs and population that we can scarcely consider ourselves to have done more than get a glimpse of the problem of establishing agricultural economics work in these vast areas of which include half the population of the world, approximately three fourths of whom can reasonably be considered as agricultural people.

A similar suggestion of meagre beginnings comes from a rough estimate of the number of Ph.D.'s awarded in agricultural economics by American institutions since 1945. This I did not attempt to find out precisely. However judging from the degrees awarded by the 14 or 15 institutions where one would expect most of them to be granted—the total number of Ph.D. degrees in agricultural economics that have been awarded by American universities since 1945 to students from the so-called underdeveloped areas, probably does not exceed 60 to 75 and may be less. There are, of course, a few agricultural economists with Ph.D. degrees earned in America in earlier years. And perhaps a larger number with the doctorate from British, European and Asiatic universities.

I have virtually no basis for estimating the number of students from underdeveloped areas who have completed Master's degrees only in agri-

cultural economics during this postwar period. However I would suppose this number to be a low multiple of the number of Ph.D.'s awarded—probably around three times as many.

Neither do I have a clear idea regarding how many specialists in agricultural economics there are in these areas or should be on any carefully calculated basis. But I am certain that persons trained in agricultural economics in these areas are so few, in all save five or six countries at most, that serious analytical work on the economic problems of agricultural development and adjustment can scarcely be said to have begun.

There are really three distinguishable major difficulties in establishing agricultural economics work: (1) The men who have been trained in this country in agricultural economics are very unevenly distributed. Excluding Egypt and South Africa, there are extremely few agricultural economists in Africa—one or two American Ph.D.'s in the last decade. There are several of the nations also in Latin America, the Middle East and Asia as well, where none are to be found. (2) Those who do receive higher degrees are likely to find themselves holding administrative positions and there may be no other way to get enough salary to live on. I know of one major Middle East country with two recent American Ph.D.'s in agricultural economics, neither one of whom is working effectively at his specialty. Furthermore, it seems that most of the foreign students who come to the U.S. and who are either supported here by their governments or whose families are supported at home by their governments have a binding commitment to serve their governments usually one year, sometimes two years, for each year of study they have in the U.S. This may allow the student a minimum of discretion in jobs. (3) The very conception of the function of agricultural economics teaching and analysis is not well understood. Possibly the need for the study of economics does not become apparent until some effort has been made to develop a country with technology alone—either to the administrators of a country or their foreign advisors.

Also, if I have treated the problem and responsibility for establishing agricultural economics work in the underdeveloped areas as an American responsibility, no slight was intended upon our colleagues in other countries. We are considering U.S. problems here. Especially in Europe, India and Japan there are important centers of study. However, I am moved to remark that we should not expect to see great graduate centers of research and teaching in agricultural economics flourish and multiply rapidly into all the underdeveloped areas of the world. The degrees of basic freedom and the security of expectations requisite to genuinely free inquiry in the social sciences remain to be established over much of the earth.

II

In any review such as this, it is, of course, the future rather than the past which holds our deeper interest. At the moment, early December 1956, the future for graduate work of foreign students in the U.S. is most uncertain. It seems altogether likely that the movement of students from the Middle East will be virtually stopped until the present crisis clears up. It is also a reasonable expectation that economic dislocations may temporarily curtail dollar funds available to students over a much larger area. However there will be offsetting considerations and over the next decade it seems to me most likely that we shall have a greatly expanded number of foreign students in this country, particularly from Asia, Africa and the Middle East. This will be particularly true, if our government should decide to make a greater investment in the basic training of young people in the underdeveloped areas. In such event, we might very well be called upon for a multiplication of effort at instruction in agricultural economics. It is very sobering, it seems to me, to ask ourselves what we would do in our departments of agricultural economics if we had three times as many foreign students as we have had in recent years. For the remainder of this paper, I shall assume that we shall have over the long pull at least as many foreign students as in the recent past and my own guess now is that we shall have many more.

Most of us would agree, I believe, that we should modify our programs of instruction in some manner to better fit the needs of foreign students. The report of the Committee on "Effective Cooperation with Agricultural Economists Abroad," under the chairmanship of Professor Case at the last annual meeting, indicated this quite clearly. We are groping for ways to combine the teaching of American and foreign students in ways that will benefit both groups.

In earlier years of this association I would suppose it may have been more practical to simply admit foreign students to the classes and then proceed with the usual discussions of principles and American problems. I have the impression that there were several foreign students in the departments of agricultural economics following World War I—from Japan, Britain and elsewhere, at least some of whom have become distinguished economists—implicitly recommending this method, I suppose. However, times have changed. The agricultural economy of the U.S. has changed so drastically since the early twenties that the lessons from our experience now need much more careful interpretation for students from other lands than was true in these earlier years. Also, increasingly we are drawing students in larger numbers from countries that are really underdeveloped economically. Although I am more persuaded each year that the American experience is valid and valuable as guides for policy

in underdeveloped countries, it seems quite clear that the experiences of American and foreign students are much farther apart than was true a generation ago.

I have the impression that the foreign students who have done graduate work in agricultural economics in this country are rather well pleased with their programs. I have not made an attempt to canvass systematically one-year students or those who were recipients of Master's degrees, but my impression from visiting with them in several different countries is that these men look back upon their stay in the U.S. with deep satisfaction. Indeed such memories seem to sustain them in their hours of discouragement. For the most part, however, I suspect that the great benefits to these people were not so much their technical training as their exposure to our way of life; the spirit of equality in our classes, with the give and take between instructor and student; the realization that Americans work very hard; the functioning of democracy in the home; the role of voluntary associations among our amazingly competent hard-working farmers; the super markets and high-quality food, etc.; and the freedom and status of women.

Although the professional problems before us are presented in most concentrated form in our Ph.D. programs I want to make a few comments on Master's degree programs. I have gradually come around to the view that we should make some very serious and systematic experiments with something like a rural social science Master's degree, particularly for foreign students who do not expect to proceed directly for a doctorate in economics. The needed theoretical core of such a program would have to be created. Furthermore, I would not think it relevant in such a social science concentration to have the theoretical core elaborated from a few major premises of sociological, economic or philosophical theory. Rather, I would suggest that we attempt to take the basic concept relevant to rural development from several disciplines, and working with the foreign student experiences and situations, build up some integrated system of ideas from these simple concepts.

There is a surprisingly large number of our concepts for which there is no clear equivalent in the experience and languages of the students from other cultures. Even a common concept such as farm really means almost nothing to most students from Asia. Why should it? They do not have farms as our eyes see them here. Rather the peasants have a hut in a village and cultivate tracts of land scattered about the village. If they are tenants they probably shift tracts from year to year. Similarly we have found that the terms "community" and "community development" translate in at least some of the Asiatic languages with quite different connotations than in our own American-English. Also, we look

upon debt as a means of acquiring capital that will enable a farmer to move toward a more efficient scale of operations; but my impression is that debt means servitude and potential disaster to the peasants of Asia— and I have found this abhorrence of debt reflected in the thinking of professional people.

However, the most that a Master's degree program can do for a foreign student, especially if it is taken in the minimum of time, is to help a student acquire an appreciation of the power of scientific inquiry; help him naturalize his scientific outlook in terms of his own culture; and give him a few investigational tools to work with. The basic justification for attempting a Master's degree program with a social science orientation, however, rests upon the cultural fact that the societies in the underdeveloped areas of the world are not functionally specialized into political, economic, social and religious institutions to the degree found here; neither are there economies thoroughly market oriented.

In making this suggestion, I am aware that foreign students and their sponsors do not want a cheap and inferior degree. This I am not suggesting. Rather, what we need in my judgment is a more relevant system of guiding ideas than can be had by studying exclusively theoretical courses implicitly oriented to American conditions.

It is, however, to the Ph.D. programs for foreign students that we need to give our most serious consideration. The doctorate represents the mininum training that men require if they are to establish a field of scientific work in a country—such as agricultural economics. Furthermore if we as a professional group can meet the requirements necessary to guide foreign students adequately through the Ph.D. degree, we can meet all the other tests such as conducting short-term training courses abroad and counselling with foreign governments. The Ph.D. is a research degree and should remain so, in my judgment. The problem is how to make it effectively so for foreign students, particularly from these countries on the threshold of economic development.

The near unanimous judgment of the recent Ph.D.'s in agricultural economics from whom I have had replies is that foreign students should prepare dissertations on the problems of their own countries, or cultures. They recommend a library thesis on their own problems over a primary-data research project on American agriculture. Partly they do not feel competent to really analyze American problems. Partly they fear getting out of touch with their own problems at home. This is their deeper concern, I believe. As this latter point has been explained to me, these men go home to face administrators immediately who are completely absorbed in the problems of their own country and they do not want to flunk their first exam, so to speak. They will be tested and judged on what

light they can shed on the problems and predicaments of their own countries. This is as it should be.

Most of us, I believe, have been accepting Ph.D. dissertations from foreign students oriented to problems in the students' countries, based upon very meagre, even tentative data. They are acceptable primarily, I would suppose, basically because of the pointed formulations of relevant ideas and theories. We have had no better alternative, and we have accomplished something valuable. However, this kind of thesis becomes increasingly less creative and less useful with the growing number of degrees awarded. Furthermore, this experience may not actually give a student much help in establishing an original research program at home. We should admit, it seems to me, that we have been improvising. I have no doubt that we shall be forced, before very long, if we continue to accept foreign students as Ph.D. candidates and maintain quality, either to throw a very heavy responsibility upon the student—such as going home to undertake a research dissertation on his own and then return to us—or we, the faculty, will have to go abroad to the problems under investigation.

The most feasible alternative, in my judgement, is for us, the supervisors of Ph.D. dissertations in agricultural economics, to go with our students to these foreign countries and become, so to speak, new missionaries of research. The research done by our graduate students in this arrangement would then serve the double purpose—as is our usual practice in this country—of being a way of meeting dissertation requirements while doing basic research that contributes to the dependable knowledge of the economy and area. In terms of the basic idea, I am only suggesting that the universities that accept foreign students for higher degrees in agricultural economics, must, if they are to remain true to the conception of a university, accept at least enough research responsibility so that members of the faculty guiding students can really instruct them. In saying this I am not unmindful of the financial, administrative, or the professional problems that are involved. But the stakes are high, higher than most of us imagine; and the opportunities for professional and public service are probably greater than we can comprehend.

Our primary job as teachers, economists and investigators, is to understand the deeper issues, the real nature of the need and opportunities, for professional training and basic research on the problems of these old rural societies who are now struggling to achieve economic development. To me, the case is so compelling for what I am suggesting that I have no doubt that the ways and means, including inspired education leadership—here and abroad—will eventually be forthcoming.

The political and economic order of the world, literally of the whole

world, is being reshaped in our times. Empires are dissolving; new nations are being born. What we are struggling for is a new world community in which people can live in a tolerable peace both as citizens of their own nations and as citizens of the greater international community. In this process, either the plain people are going to see some promise of bread and freedom for their children or we are going to live on and on in an endless sea of world turmoil and revolution. This civilization cannot stand. Most of the people of the world are peasants, and although countless millions of them live and die like mere animals, they are on the whole hard working, intelligent and civilized people. In my humble judgment, they are a people who are not well understood—even by their own countrymen. Yet to these people, these peasants, and their cousins who have drifted into cities, the new nationalism and the popular-franchise democracies are giving political power. We must understand such problems. I am not saying that these problems fall wholly within the scope of agricultural economics. But I would plead that our role in understanding such problems is basic and indispensable. The courageous and brilliant young men who come to us as students from the ends of the earth give us an unparalleled opportunity and responsibility.

I have suggested that we might make a major contribution by turning, in a firsthand way, the research talents of our foreign students and their counsellors to the research understanding of the social and economic problems of the underdeveloped countries. This cannot of course be done wholesale, but it needs to be done in a sufficiently organized way to make some impression. My hope is that there would develop a few centers of rural social science research that would be genuinely cooperative between local colleges or universities and American universities where graduate students from all over the world, but particularly from that region and this country could go and do field research on rural social science problems of the host country. This is only a slight extension of work now under way cooperatively between the so-called sister colleges or universities—with an American staff joining hands with the faculty of the host college.

This would require money—lots of it, when compared with our usual research budgets in the social sciences, but really trivial amounts when compared with world outlays for defense and development purposes. A few such pilot projects are not beyond the capacity of our great foundations; neither would it take many changes in our foreign aid programs to give this kind of project a secure financial base. The critical financial problem faced by land grant colleges in undertaking this kind of expanded and enduring responsibility boils down in the last analysis to underwriting permanent tenure positions for people who are employed

on temporary funds for work overseas. If foundations would create a few endowed chairs or give salary guarantees for 10 or 15 years the results could be very great. And, if the ICA could make 10-year contracts, as was recently requested by President Eisenhower, this would also be a good beginning.

What is needed, above all else, from ICA, however, is the recognition that it takes more than one year to train an economist—and that investment in fundamental professional training of economists up to four or five years may be the most productive form of economic and technical assistance possible to underdeveloped areas. Having said as much I feel constrained to add that I seriously doubt that any great number of American universities will really want to undertake the kind of comprehensive on-campus programs of supporting teaching and research in foreign languages, history, philosophy, etc.—that a creative center of overseas research in rural social science will ultimately require. We can, however, and should, work out programs of institutions working together in this country so that no willing talent will be idle.

When we think of the overseas centers that might be established in the kind of international university cooperation suggested here, it would be better, it seems to me, that we help establish and develop this research approach to social and economic problems and education by working with the more forward looking indigenous educational institutions in the region. Otherwise we should have to develop alternative institutions, such as United Nations or American universities as we could, in hospitable and promising locations. My brief explorations abroad on this subject lead me to think that there are several ready and promising opportunities for genuine cooperative teaching and research in rural social science as envisioned here. I would emphasize that this should be a genuinely cooperative arrangement in which faculty members from the overseas cooperating university would be expected to come to the American campus and participate as full-fledged faculty members in research and teaching. They could introduce students from their countries to America through their research program here.

We should recognize from the outset in such a venture as this, that our ultimate objective is to help build centers of social science study that will grow into continuing self-sustaining creative centers of learning. This should be our aim. We shall always have to take back seats, so to speak, and our ideas and findings will have to find expression through the lives of our students and counsel to our host colleagues. We can only help *them* on research projects undertaken on their own responsibility— for it is necessary to study vital and even controversial subjects, if research is to make the needed contributions. Indeed the first task of systematic

rural economic research in several countries will be to establish the *idea* of research and this can only be done by demonstrating that we can really make a contribution to the solving of puzzles confronting administrators and policy makers in the attempts to develop their countries. I have enough faith in humanity and democracy to believe that all of these achievements in research and teaching would eventually be achieved, if none of us left these shores and went forth to labor in strange vineyards—given the time. But is there time for this? I doubt it. We must somehow find ways to do in 30 years what might be accomplished in 300 years of laissez-faire—if at all.

For our part, we prospective research students abroad shall have to reorient our thinking a very great deal. Agricultural economics has developed in this country around what we might call the three D's—Depressions, Disequilibria in resource use, and the Disadvantaged position of farm people in a surging industrial economy. The major premise of agricultural policy and therefore of agricultural economics in the underdeveloped areas of the world is essentially the question of, After Feudalism, Tribalism and Colonialism, what?—where most of humanity is bogged down in agricultural pursuits—in poverty, inefficiency, despair and injustice. The promise that Western civilization holds out in its finest expression is essentially that free men are stronger than slaves; that freedom is an institutional achievement, which releases creative energy that in turn is the fountain from which flows efficiency.

When we really understand what our students from underdeveloped countries are up against in their own careers we will then be in a position to reorganize our course work and examination requirements for the Ph.D. degree. When that time comes it seems a safe prediction that we shall find ourselves discussing alternative economic systems—Communism, State Socialism, Capitalism—as basic problems in economic analysis. Also I think we shall find that our students, and we their teachers, must stand for something valuable. My little experience on this frontier persuades me more deeply than ever that economics must be more than a system of analysis. Economic analysis must have openly recognized connections to the great policy issues—openly recognized and as objectively analyzed as is humanly possible. Such objectivity may actually be easier abroad than at home. But in any case, our students will have to take some firm positions on great questions in political contexts of sweeping instability. They will need to know where we stand.

Regarding courses of instruction I incline to the view that we should give more attention for both foreign and American students to a comparative study of national agricultural policies, tenure and credit systems. It is such considerations and arrangements as these by which the eco-

nomic opportunities in farming in a country are shaped up as accessible alternatives to the actual cultivators—and within which the decision-making processes and innovations in technology become operative in the farm economy.

When we know enough to do these things for foreign students, and are equipped to do so, which is the topic before us today, we shall find also that we will then be able to help our American students prepare for careers in international service. I would hope that a substantial propor-tion, say one third, of the graduate research students in the overseas cooperative research centers would be American students—preparing for professional careers. This is really another story. But I think that the moral is again that by serving others we serve ourselves.

The specific problems to which we as investigators, as agricultural economics researchers, in underdeveloped areas should turn our atten-tion are not very different in name from what we do every day. The context is different. I am sure that it has been the experience of all of us who have attempted to teach economics and methods of investigation to foreign students on their home grounds or consult with public officials on their problems, that we have felt humble, ignorant and inadequate. Yet also we find even the simplest economic concept, such as we try to impress upon sophomores, to have a power that is almost majestic when turned to understanding the confusions and troubles of our friends and allies abroad.

We have been trying to think through the issues and make some sug-gestions about how our graduate teaching program in agricultural eco-nomics in the United States might be modified to better meet the needs and opportunities presented to us in serving the world community. These suggestions are for marginal adjustments in our programs, and like all marginal analyses, presume the continuation of the relevant going con-cern, in this case, of the work we are doing on U.S. problems. I doubt that the basic interrelations of any other major sector of any other economy in the world are understood as well as our group understands the agri-cultural economy of this country. Similarly I doubt that any other group of social scientists has within their scope of activities a grasp of the basic elements of combined thought and action on economic and social prob-lems, both public and private, as does the group of agricultural economists in this country. Furthermore, I do not believe that any other group of American social scientists has as good a prospect for helping establish productive research on the economic and social problems of under-developed areas as we do—and I know that this view is shared by eminent social scientists in other fields. Finally, I do not believe that the inter-national responsibilities now being assumed by our national government

for giving support and counsel to the peoples of the earth seeking development after centuries of poverty, despair and domination, can be met unless groups like ours undertake the tremendous task of helping to think out and think together the deeper implications of issues in national and international policy. No group has a greater opportunity and professional responsibility for basic policy analysis than we do, and our graduate students from other lands can be both our helpers and our teachers—if we but give them a chance.

DISCUSSION: TEN YEARS OF F.A.O. STATISTICS AND ECONOMICS TRAINING CENTERS

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First, I wish to commend Dr. Ezekiel for his thoughtfulness in getting this paper into my hands long before this meeting. As a consequence, I lack the usual alibi of discussants that they have not previously seen the paper.

I will first do the usual thing—look for and expose positions taken in the paper with which I disagree and points that I believe have been omitted or inadequately treated. I then hope to make such constructive suggestions as have occurred to me.

To begin with, perhaps he is too close to this program and I am too far away from it to make an adequate appraisal. My chief criticism of the paper is, I believe, related to his nearness to the program. I found the paper concerned almost exclusively with description and lacking in critical analysis and evaluation. My explanation may easily be wrong, but knowing him as we do, I attribute this failure to his official relationship with the FAO.

After making this general criticism of the paper, it would be presumptuous of me to be very specific in criticism of the program, since I am so far removed from it. The staff of the Economics Section of FAO has no doubt spent many hours planning and reviewing these programs, while I have nothing much to go on but written reports and some general ideas about the matter that come from contacts with agricultural economists and students from the countries involved.

I will, as a consequence, confine myself mostly to asking questions, rather than passing judgments.

Dr. Ezekiel in his paper reviews the early work of the Division of Economics. He recognizes the need for a long-time and comprehensive attack on the training of agricultural personnel in all countries studied.

He then suggests that this long-time program was side-tracked. "Much quicker acting methods were necessary if the level of existing professional workers in the less-developed countries was to be brought up near to that of other countries in a reasonably short space of time." Later in the paper he reports on the recommendation of many lecturers that improperly qualified participants be excluded, as follows: "This is simply impossible, because there are few fully qualified men in underdeveloped countries, and international training must start with improving the ability of the men who are doing the jobs. Unless we take the possible participants as they are . . . we would not have any body of participants at all."

Other references are made to the uneven quality of students, to the method of selecting participants, to the status of the participants, and to the language difficulty. In addition to this, I believe there is another difficulty, namely, that participants are nominated by the governments concerned (FAO has no veto power). As a result, factors other than academic or professional competence are likely to govern selection, particularly in countries where the need is the greatest.

This formidable inventory of difficulties leads me to ask these questions:

1. Do these training centers provide an effective educational short cut to accomplish the purpose of FAO?

2. After almost ten years, might the program have been further advanced had the original concept of a long-time, comprehensive educational program prevailed?

3. In general, might it not be more effective to hold small conferences with smaller staff within particular countries, where the training program could be tailored to the special needs of the country?

4. Can or should FAO operate educational programs with this formidable array of handicaps and its inherent lack of authority to screen and discipline its student body as a university should? Dr. Ezekiel refers to these training centers as "really *ad hoc* graduate schools." How many graduate schools would put up with "participants" about whom it could be said, "The words 'student' or 'trainee' are barred as too derogatory to the dignity of professional men already established in their own countries."

5. Why not create, at strategic points, training centers associated with a college or university where continuing programs could be developed and where residual values could be carried forward?

6. Should FAO be in the education business, or should it use its good offices to support and promote education through institutions organized for this specific purpose?

Most of us are committed to the educational philosophy that education should be free from direction or control from either the church or the state. In the United States we have gone to great lengths to insure that public support of education does not involve political control.

Is it possible to create within FAO an educational environment that even comes close to that which we take for granted in a university in any of the advanced countries of the West?

In general, the more elementary the training needed, the closer to home it should be done. Parenthetically, this is a major problem in the intelligent admission of foreign students to American graduate schools. A large percentage of these students who come to us would be better served if better adapted educational and training programs were available to them at or near their homes.

In the event the conclusion was reached to decentralize the training programs into particular countries, I suppose the whole matter of jurisdiction would arise, since this is the type of program involved in the technical assistance of our governments or contemplated in the universities' contract programs in which many of our universities are now involved.

If we accept the fact that the students profit from these training courses there are two important considerations that may militate against any useful results so far as the cooperating countries are concerned:

(1) The student may return to his bureau of statistics or department of markets to find an institutional set-up such that he cannot apply his new-found knowledge, either because of the organization of the department or because no worthwhile statistics are available for analysis.

(2) He may return to find no job at all. These centers, I am sure, face the same problem that we face in American graduate schools. These newly trained students return home only to find no jobs open to them that use their new competence.

This is a problem met by some of the Foundations that give fellowships for study abroad only when they have assurance that the student, once he is trained, has a proper job to which he can return.

Dr. Ezekiel reports that "In a few cases, the careers of participants in training centers have been followed up for a few years by questionnaires sent to them and to their governments. These have shown that nearly all have applied the knowledge gained."

In view of the undoubtedly heavy cost of these programs and the apparent dependence on them to accomplish the purposes of FAO, this appears to be a totally inadequate scheme of evaluation. It seems to me that only with a comprehensive on-the-ground study could the subsequent performance of participants be judged.

Since I have, at least by implication, questioned the value of these

centers as now organized, I must in fairness suggest some kind of alternative. Here, in summary, is my proposal:

1. Return to the original concept in FAO of a long-time and comprehensive attack on the training of agricultural personnel in underdeveloped countries. To accomplish this I would attempt to develop within these countries educational programs associated with indigenous schools and universities. If none is available or if conditions are unfavorable for their development, then encourage applicants for training to apply for scholarships to study in regional research and advanced training centers attached to on-going educational programs in established universities.

I understand that at least three such centers are emerging in Asia, each of which will serve a region similar with respect to (1) race and culture of the people; (2) first and second language; (3) general type of agriculture; (4) stage of development. The institutions most likely at present to qualify, in my opinion, are: Region 1, The India Agricultural Research Institute and Graduate School, New Delhi, which might serve India, Pakistan, Burma, and Ceylon. Region 2, The University of the Philippines, College of Agriculture at Los Banos, Manila, which might serve the Philippines, Indonesia, Thailand, Viet Nam, Cambodia, and Loas. Region 3, The University of Tokyo and the National Institute of Agricultural Science, Tokyo, which might serve Japan, Korea, and Formosa.

My suggestion, then, is that FAO pitch in with ICA and the foundations to make these effective training centers.

2. Modify these FAO training centers so that they become in effect regional conferences in which such learning as takes place occurs through exchange of ideas among trained persons engaged in similar activity. This puts the participants on a par with each other and avoids the difficulty cited by Dr. Ezekiel with respect to their status—no one would then be talking down to them.

UNITED STATES TRAINING FOR FOREIGN STUDENTS IN AGRICULTURAL ECONOMICS

H. C. M. CASE
University of Illinois

THERE are occasional incidents that contribute much to one's point of view. Just a decade ago, as a member of an agricultural mission, I visited a small agricultural experiment station in the interior of China. The staff had carefully translated about a page describing each research project under way. Leafing through the collection I found this title: "The Reaction of the Small Intestine of the Rabbit to Various Stimuli."

If rabbits were ever indigenous to that part of China I am sure the last one had found its way to the pot many years ago. I was perplexed and asked to see the staff member carrying on this project. He told me he had been reared in a large Chinese city and had completed the last of his high school training in the United States. He became interested in biochemistry and after graduating from college decided he had better secure a doctor's degree while he was here. Apparently his instructor, having to suggest a study for his doctoral dissertation found rabbits easy to obtain, hence the thesis topic.

Upon returning to China officials told him that China needed trained men and since he had had the latest training he was asked what he was prepared to do. He had never had an opportunity to learn the rural problems of China, having left his home land about eight years earlier before reaching maturity. Upon his return he was thrown into an environment with which he was not personally acquainted. When asked what he was prepared to do he apparently truthfully said he was prepared to continue the research on which he had prepared his doctoral dissertation. There was no indication in my interview that there was any plan to learn new facts or to apply the results of the research to rabbit production or to the raising of any other kind of livestock.

Who was to blame for this misapplied effort? One could not entirely blame the student and probably we should not condemn his instructor too severely. However, the instructor had failed to teach his student principles in a way that prepared him to apply them to practical problems. One might pick from this story certain suggestions for further consideration including the selection of foreign students for training, the proper orientation to our college courses, the preparation of instructors, and the orientation of students for effective work on their return to their home country. We should not overlook the necessity or obligation for better preparation of our instructors who deal with foreign students, and our obligation to train students to meet situations in a way that will

enable them to be of greatest service when they return to their own coun-
tries. With this background, may we turn to the subject in hand.

The Setting

I wish to commend Professor Parsons for a very carefully prepared
paper which has given major consideration to both the quality and type
of training the foreign student should receive and the best means of
attaining it. The experience many departments of agricultural economics
have had in training students from foreign countries, plus the personal
experience of staff members in foreign areas, should provide a basis on
which we can consolidate our experience and build better for the future.
If we are not scrutinizing or revamping our plans we are not profiting
from the experience now available to us.

I wish to commend Parsons for giving emphasis to the problems stu-
dents must meet. I hope those of you who carry any responsibility for
teaching foreign students have at some time tried to imagine that you
have completed an undergraduate degree and are about to enter gradu-
ate study in a country having a different language, and probably with
pronounced differences in instructional methods, social attitudes and eco-
nomic organization. I am very sure you could imagine many situations
where you would like to have more guidance than you have offered some
foreign students with whom you have worked.

As he has so well indicated, we have not given enough attention to
the contrasts a student meets in our country. Our agricultural economics
courses designed for our own students are not ready-made answers to
foreign needs. Our modern farm homes with labor-saving devices and
central heating are far removed from the huts that house more than
half of the world's farm population. Our fully mechanized farm unit has
little in common with a dozen parcels of land tilled mainly by hand labor
and a little animal power. It is difficult to apply the same principles to
the commercial farm with most of the family needs supplied from the
food and department stores and the self-sufficing farm of most of Asia
and Africa. Credit as we think of it and debt in some countries are quite
different concepts. Within recent weeks, letters from several former grad-
uate students, telling of their responsibilities on government missions and
in planning the agricultural policies of their home countries, leads me to
want to replan or, at least, to supplement their former teaching.

Orienting Foreign Students

Without attempting to build more of a background, I should like to
emphasize several problems and suggestions. How is the student to make
his adjustment? Many students have an inadequate knowledge of our

language and find methods and types of agricultural production quite new to them. They are probably unacquainted with our methods of instruction, social customs and other pertinent aspects of our social and economic life. In recognizing that many of our land-grant institutions, through the International Cooperation Administration, have now accepted some major responsibility in an advisory capacity and instructional assistance in foreign countries, perhaps we are now ready to consider marked changes in our methods of giving these students the training and instruction they desire. Administratively, the institutional responsibility for some distant area has no doubt opened many minds to a more careful appraisal and even a jealous concern in giving students from these foreign areas the training they need to render specific service in their home land.

Perhaps the time has arrived when instead of having foreign students reach the campus just in time for the fall semester, or even a few days late, it would be desirable to bring them to the institution two or three months earlier and to devote this period to orientation. Too many foreign students scarcely get away from the shadow of campus buildings. A well-planned orientation program might include all new foreign agricultural graduate students, regardless of their specific subject-matter interests. The program might include improving their use of the English language. Since the student's major interest will be agriculture, the summer period is the ideal time to acquaint him with many farm operations and methods of production with which he is not familiar. A rural community should be studied so that the student learns how a typical rural community functions with regard to the official responsibilities of local governing bodies. Also, a thorough understanding of voluntary community organizations affecting the social, religious and economic life of our people, including the functioning of cooperatives and other farmer organizations, would be enlightening and at the same time provide some informal but effective training in social customs and usages.

A major objective should be to give the student much the same understanding of agriculture that a native of our country would have acquired during his apprenticeship in agriculture while on the home farm. Although some institutions may have an adequate number of foreign students to justify such an orientation course on their own campus, the students are, of course, scattered over a three-year span of training. There is no reason why three or four adjacent agricultural colleges could not in turn provide an annual orientation course for newly-arrived foreign students so as to make such training as efficient and comprehensive as possible.

A thorough understanding of a progressive rural community, including

an understanding of the responsibilities carried by individuals in the various governmental and voluntary institutions, should prove one of the most practical means of bringing into focus the principles involved in a free society. This should help prepare students to better understand some of the fundamental principles of democratic government affecting basic agricultural economic teaching respecting such items as credit, land tenure, marketing cooperatives and social organization.

Selecting Foreign Students for Advanced Study

Any orientation that can be given foreign students upon their arrival in this country cannot make up for their lack of knowledge of agriculture in their home land, especially for those whose early life may have been spent in a large city environment. Nor can it make up for deficient study preparatory to registering in graduate courses. This situation illustrates the need for the most careful selection of the right foreign students for advanced training in this country. If any financial assistance is given to students to come to this country, every precaution should be used to choose well-prepared mature men of real promise in the field of agricultural economics. The term "well-prepared mature" should be defined in part to include a thorough appreciation of problems pertaining to agriculture in their own countries. As now, those coming from wealthy families who pay their own way would be free, no doubt, to decide on their course of study without being subject to selection, but careful direction can be given to such students.

Improving Instruction

There are many suggestions that I believe should be made to instructors who have foreign students in their classes. Most of our instructors are prone to discuss agricultural matters in a way that assumes the student is thoroughly acquainted with our agriculture and to use examples and expressions that are unfamiliar to foreign students. This situation emphasizes the need of some personal attention being given to students outside a classroom by the instructor. This also emphasizes that a department undertaking the instruction of foreign students should have one or more staff members who have had effective foreign experience to prepare them to serve as advisers or guidance counselors for foreign students. If such advisers have recently returned from abroad, their administrators should ascertain that they are not so over burdened with current teaching or so busily engaged in catching up on research responsibilities that they do not have adequate opportunity to work with foreign students. When assistance to foreign students becomes a financial burden to a college or a department of subject matter, there may be a good case to present to

some major educational foundation with international interests.

With all due regard for the good work that research workers are doing in this country in the field of agricultural economics, many of them will fall short in their knowledge of the type of research work foreign students will do when they return to their native countries. In the less-advanced countries, research workers in the social and economic field should begin more nearly where we were 40 years ago in the type of research activities. Also, in less-developed countries research may properly emphasize problems of national scope to a greater degree than is normal of a land grant institution. To me, it is pathetic to find a man, presumably well trained in the theory of agricultural economics, who returns to his native institution and withdraws into his ivory tower to teach abstract theory devoid of practice, because either he or his instructors have failed to see the application of graduate teaching to the economic problems of his region. I could elaborate on an example of a Ph.D. graduate from another continent trained in the United States and teaching on a third continent. In a long visit I could learn nothing helpful from him regarding the agriculture or its problems in the region where he was employed.

Most foreign students place too great importance on attaining an advanced degree. Foreign students entering upon graduate study in this country come from widely differing educational environments. Part of this difference is due to the educational system of the particular country from which they come. More especially the difference is because of the educational standards of particular institutions, which differ widely in any other country just as they do in our own. One of the greatest weaknesses is likely to be that the student lacks a practical knowledge of agriculture and of the basic training in agricultural science such as has become relatively quite standardized in our land grant institutions. An adequate orientation program will afford an opportunity to appraise a student's knowledge of agriculture and of his previous training in agricultural science. In many instances a foreign student does not have a good basis for judging the precise training he wants. Neither does he have much basis for choosing the institution to attend to provide the basic training he needs. Many times it may serve a student's needs best if it is recommended that he take adapted advanced undergraduate courses in place of devoting his full attention to courses at the graduate level leading to a Ph.D. degree. By recognizing the type of work a student may do upon returning to his native land, a master's degree supplemented with good advanced undergraduate training may have more value to the student than a Ph.D. degree heavily loaded with prescribed courses and the general academic attainments required of Ph.D. candidates. A student who has already mastered two languages may have little actual need of

doubling that number to be highly useful in the position he is to fill. If it is a matter of choice, more time might well be spent in learning to interpret the problems of his own locale and the methods of communicating effectively with the farm people of his home land. This statement does not belittle the desirability of a doctor of philosophy degree, but it emphasizes the desirability of a sound, broad undergraduate preparation.

Post-Graduate Study Orientation

I believe a second orientation period is needed upon completion of his studies before or after the student returns to his native country. I am quite sure, in talking with students about to return to their home countries, that some of us have recognized that they have failed to identify their graduate training adequately with the problems they will meet upon their return home.

How can this handicap be overcome? Dr. Parsons placed emphasis on this problem and his suggestion of sending professors abroad to work with students has merit. Such a plan will meet some practical difficulties including that of finance. An alternative suggestion is to devote a summer period to an orientation session where the staff of what might be termed international professors of agricultural economics would work directly with a group of students to formulate an outline of courses adapted to the scope of the future teaching activities, to plan typical research projects designed to fit the national needs and the locale where the research will be done, and to outline extension projects adapted to working with native rural people. If at all possible, such an orientation period should be spent where there are at least some similarities as far as the kind of production is concerned and if possible where the farm units are not too different in size. If the students have not previously had some experience, for example, in collecting original data from farmers or market centers and other sources, time could well be spent in planning the questionnaires to be used in certain types of research and it would be desirable to test out such questionnaires in the actual collection and editing of data. This type of training might readily expand to include the selection of statistical techniques appropriate to the specific problems under study.

I do not overlook the suggestions of Dr. Parsons that the desired orientation should be accomplished in the student's home land. Rather, we should examine its possibilities. Perhaps a workshop could be set up in a foreign country for returning graduate students to that country and adjoining countries having similar conditions. Such a workshop should be so organized as to include former graduate students who have had some years of research experience. To the latter group the post-graduate

workshop would afford a chance to analyze with other workers the problems encountered, while the returning students would be initiated into the setting where they would be expected to find their niche.

Trial and error in holding such a workshop might well determine the proportions of newly-trained and formerly-trained persons and the contribution in personnel from our country that would develop the best type of training. I would add the suggestion that in holding such workshops it would be well to select a few men from our own country who might be eligible for sabbatical leave from their home institutions, and who would profit by becoming better prepared to work with foreign graduate students as the result of traveling to the foreign country, spending two or three months in becoming acclimated, and then participating in the workshop. This is one method of training and recruiting international professors. It would, as suggested, call for large funds to support such an undertaking, but this is not an insurmountable obstacle if the idea proved acceptable to some major educational foundation. In fact, this might prove to be the best means of orienting newly-trained graduate students to their future tasks.

Building for the Future

In closing, I would emphasize that there is ample evidence of need for continuing contact with former graduate students abroad in order to help recharge their enthusiasm and stimulate the development of new interests. Such contact should be broad in scope, reaching more individuals than can be effectively handled in a workshop. Also, such contact should not be limited by national boundaries of countries. Within a country, a national farm economic association has a place as soon as there is personnel to support the organization. In some countries there is need of a national economic association with only a sectional meeting devoted to agriculture until there is adequate personnel to give vital support to an agricultural economic association.

The continuing over-all type of contact I have in mind requires developing further the International Conference of Agricultural Economists to serve as a liaison between agricultural economists throughout the world. Such an organization should function in stimulating better graduate student instruction for both foreign students and native students who later may find their field of work in a foreign country. More explicitly, our instructors of foreign students or of native students training for foreign service will have their understanding deepened and outlook broadened by such periodic contacts as are offered through the triennial International Conference of Agricultural Economists.

In addition, an international organization should serve first of all as

a contact medium for agricultural economists beyond national boundaries. Such contact is sorely needed, especially by many workers who are laboring more or less singlehandedly in small institutions which are striving to establish a good level of instruction. In larger institutions fellow workers furnish inspiration to each other, but isolated workers are seriously handicapped when their stimulus must come largely from printed material and their devotion to their task.

A conference where people meet on a common level provides good opportunity for educational advancement and we need to cultivate and develop this medium. As part of a well-rounded program, then, the International Conference of Agricultural Economists should rekindle enthusiasm and help scattered agricultural economic workers acquire knowledge over wide areas, especially to help provide stimulus for meeting the needs of the rapidly expanding program of teaching, research and extension. After having formed many close associations with students and instructors from different countries during college days, some common bond for agricultural economists on an international basis is desirable just as the American Farm Economic Association provides such a bond on a national basis.

INFORMATION NEEDED FOR RURAL DEVELOPMENT PROGRAMS*

Chairman: Lowell Hardin, Purdue University

STATUS OF THE NATIONAL RURAL DEVELOPMENT PROGRAM TO DATE

DON PAARLBERG**
U. S. Department of Agriculture

I

SOME of the convenient assumptions made by too many agricultural economists are these:

That the factors of production, particularly the human factors, have a high degree of mobility.

That our social, economic and political structure is capable of assimilating without excessive strain, any technological improvement that may come out of the laboratory, and that the fruits of any technical advance will automatically be widely disseminated.

The measure of exaggeration in these assumptions is to be found in any statistical report on American agriculture.

In 1950, there were a million and a half farm families with incomes from all sources of less than $1,000 a year.

There are whole agricultural areas that have participated hardly at all in the technological revolution through which agriculture is moving.

To some people, this constitutes no problem since all persons have at least a nominal opportunity to participate or not, as they wish, in technological advances.

But to others who are concerned with optimum use of resources and with reducing disparity in levels of living, this is a real problem. It was so considered by the President and by the Secretary of Agriculture. The Rural Development Program resulted from this concern.

The basic beliefs implicit in this program are these:

That rural areas of low income result from restricted opportunity, limited resources and inadequate education rather than from any innate lack in the people themselves.

That the program should help the people achieve the objectives to which they themselves aspire.

That the accent should be on youth, since many problems can best be solved between generations.

The Rural Development Program is now a year and a half old. The program is going forward in 46 pilot or demonstration counties and 8 trade areas in 24 states. The purpose of the program, said President Eisenhower, is to "open wider the doors of opportunity . . . for the good of our country and all our people." We have had a limited opportunity to learn what this program is, what it is not, and what, with good judgment and the right kind of leadership, it might eventually become.

II

First of all, this is not just another government "aid" program. We have put our faith in the leadership and potential ability of rural people. We believe they can make effective use of their own resources and of the resources we can provide. In short the Rural Development Program stands on local initiative. The federal government has asked state agencies to mobilize committees of local leaders in pilot counties and to help them make a practical start on their development needs.

There are, of course, many other ways to organize a program whose objective is to raise the level of living in low-income rural areas. We might have set up a new federal agency or created a new type of federal office in counties participating in the program. But we believe that this job can be done more efficiently, faster, and with the best possible results through the continuing leadership of local people. The Rural Development Program is modeled in part on the remarkable achievement of the many area improvement groups that *have* succeeded during recent years —with a minimum of outside aid and a maximum of local leadership.

County development committees do need asssistance. Low-income farm families need educational and credit programs especially adapted to their situation. The Rural Development Program includes essential community and farm assistance, using regular state and federal agencies. But these needs are not being used to rationalize the erection of a new bureaucratic empire.

Second, the Rural Development Program puts equal emphasis on industry, and community development and better community facilities. Approximately half of the rural young men and women who reach working age transfer out of agriculture into urban employment. "Rural development" as we use the term therefore must include a great deal more than improved farming. There are many ties between modern farm and urban living. Farm people can no longer be the isolated, self-sufficient group they once were. Their prosperity and well-being depend on the economic and social conditions of the counties and trade areas in which they live.

In giving leadership to this program, the Department of Agriculture

works closely with four other federal departments—Commerce; Labor; Health, Education and Welfare; and Interior.

The participation of these departments as partners in this program symbolizes its basic objective—balanced development in rural areas. This underscores our belief that the problems of low-income farming areas will yield better to a *series* of projects than to a single approach. This series includes trade and industry development, better education and health, employment information, and improved farming on farms having adequate resources.

During the past decade, we have seen remarkable changes in many of our rural areas—industry moving in—a vast expansion in good opportunities for full and part-time work off the farm—better schools and health facilities—and better agricultural opportunities. Through the Rural Development Program we are trying to speed up these changes by stimulating local initiative and increasing the services available to selected areas.

And the third point to keep in mind: The program at present must be considered in a pilot or demonstration stage. The majority of pilot counties and areas which have been named by the states have only recently made a start. They are organizing and planning such initial projects as resource surveys and on-the-farm interviewing of people to provide information on human resources in the area. Most of these counties were designated for the program as recently as early September.

Complex problems are faced by those in the states who are charged with organization of the program. One of these is the problem of bringing representatives together from many diverse agencies and gaining unity of operation. All of us—in the federal government, in the states and pilot counties—are engaged in what amounts to a nation-wide research project. We are working with a pilot model. Changes in approach will take place. One area will stress small industry development, another vocational training in cooperation with local industry, another farm product diversification. We expect these differences. We are looking for them. Already, we are seeing a number of them.

These three features characterize the Rural Development Program: Direction of the program by local people with state assistance—equal emphasis on agricultural and nonagricultural opportunities—and its pilot or experimental aspect.

How is the Rural Development Program helping farm families on small farms adjust operations to modern-day trends?

By putting new emphasis on joint planning by agricultural and nonagricultural agencies.

By giving technical assistance to low-income farm areas to help them plan and carry forward economic development projects.

By helping more families make use of the successful farm and home unit approach to extension.

By liberalizing credit for small farmers. By urging a new look at educational needs in rural areas, both general and vocational.

Of the 24 states participating in the Rural Development Program, at least 20 have formed committees to provide state-wide direction. The makeup of these committees differs from one state to the next. But in all cases, nonagricultural agencies working in the state are represented, either as full or participating members. Thus in North Carolina, as one example, the state welfare and health agencies, industrial education, and small industries commission all have a part in the work of the rural development committee.

This planning forum provides an opportunity for real cooperation. In some instances, I am told, the first meeting of the rural development committee was also the occasion for the first meeting between representatives of one agency and another. Though each agency was working on the economic development of particular rural areas in the state they had not previously worked together. Now they are doing so. This is a good thing. This meeting of minds is one of our main objectives.

As I said previously, we do recognize that leaders in experimental Rural Development Program counties need technical aid. We are providing this aid through a variety of projects.

The Department of Agriculture, through the Office of Under Secretary, True D. Morse, has underway a program to supply state and pilot county leaders with continuing information on all phases of their development work.

Some of the money allocated by the Federal Extension Service to the states under authority of the recently amended Smith-Lever Act will be used to pay the salaries of special associate county agents and extension specialists. The special associate county agents will work full-time in the pilot counties. The extension specialists, working out of the state office, will provide continuing technical advice in the management of individual programs.

I shall cite a few examples of this extension technical aid for program development. Price County, Wisconsin, Lewis County, West Virginia, and Hardin County, Tennessee have all employed what are termed *rural development program coordinators* during the past year. Maryland has an extension specialist, a rural sociologist working out of the University, to backstop project planning in the state's pilot areas. In Michigan, Daniel Sturt, whom some of you may know, has been appointed as district extension director for the upper peninsula. He will coordinate the Michigan program in that area, bringing together the resources of all agencies and helping local leaders plan their projects.

Many state extension services plan to increase their farm and home development work in Rural Development Program counties. This is one part of a comprehensive plan to help families on small farms raise their farming efficiency when they want to stay in farming and have good potential for making a success of it. Through more intensive farm and home planning, technical assistance in soil conservation, and liberalized credit, able farm families will have an opportunity to move into efficient, commercial farming.

The Soil Conservation Service is putting additional conservationists in pilot program areas. The Farmers Home Administration now has broader lending authority. In Rural Development Program areas, the pattern of credit will be adjusted to fit local needs. New FHA employees will be put in the counties and areas where necessary. We have obtained amendments in basic legislation so that this agency may make loans to the growing number of part-time farmers who can increase their total income and levels of living through more efficient farm production.

A coordinated campaign has been started to develop job opportunities for farm people in low-income rural areas. Job development involves a pattern of work and planning requiring great technical knowledge. We are helping farm people who wish to do so to make the transition from low earnings in low-productive farming to the comparative prosperity of trades and industry. This includes vocational training, better education, technical and credit aid for locally developed industry, publicizing local resources and plant location possibilities and more effective job information. It is often difficult to place emphasis where it belongs in a particular area.

But we have made a start. We *are* trying to bring increasing services to pilot counties, helping them find employment for their underemployed rural people.

The Office of Area Development in Commerce has increased its services to rural areas. Technical materials have gone out to states taking part in the program. And specialists from this office have made personal visits to a number of pilot counties. In at least one of these counties, they prepared an analysis of development prospects.

As I have said, economic development boards, small industries, agencies, and chambers of commerce in several states have representatives on rural development committees. They are contributing their skills and technical know-how to program planning.

On the employment information side, we asked both sessions of the 84th Congress for the minimum resources needed to help the states strengthen their employment services in low-income rural areas. Both times we were turned down. As a result, state employment security agencies have been forced to do what they can with the resources they have.

In some states, notably Tennessee, those agencies have taken steps to provide better job information for farm people—at least one new employment office has been opened in a pilot county there.

In this whole field of off-the-farm job development, we have yet to learn the most effective coordinated approach. We have yet to learn what combination of factors will produce the highest level of employment opportunity in a particular county, area, or region.

As you know a number of "area development" measures were discussed in the past Congress. They differ in the amount of aid for business and industry development. They differ in kinds of aid, and, I might add, in value and practicality. The new Congress will undoubtedly consider one or another of these bills again. The important point to keep in mind, however, is that the Administration, the Congress, the states, and numerous private organizations have an aroused interest in the economic and social advancement of depressed areas, both urban and rural. The idea has taken hold that the United States can not afford the human and material waste of underemployed people and idle resources.

In this respect the Rural Development Program is a pioneering effort. As we help and encourage the states to take measures encouraging the use of underemployed farm manpower, we will also be able to see more clearly what is needed. This might be expanded cooperative federal-state vocational education programs, or it might be credit for certain types of industries, or it might be new criteria for designating labor surplus areas, or it might be defense plant dispersal affecting wider areas.

I have spoken of planning and organization, farm services, and projects to increase off-farm employment in the Rural Development Program. But an essential part of the program has to do with research, surveys, and other information-gathering projects. Many counties have wisely started their development programs with an organized survey of their resources, their needs, and the desires of the people who live there. With the aid of the state experiment stations, they are taking a new look at where they stand, and where they want to go. In some cases they are using volunteers to do the enumeration.

Some of these preliminary surveys are comprehensive, giving a detailed picture of farm living, present industry, land tenure, transportation and communications, and health and education facilities.

I shall cite two typical reports based on early surveys. They not only present a vivid picture of conditions in the county, but also give us a good idea of the kind of county participating in this program.

The first is Choctaw County, Oklahoma; the second, Hardin County, Tennessee. Oklahoma A & M research and extension personnel designed the Choctaw study, with aid from agency workers in the county. Ap-

proximately one-seventh of the rural residents in the county were inter-
viewed. In addition, those who compiled the study used the regular
statistical sources. The preliminary report of this survey makes several
interesting observations:

Sixty percent of all farm families in the county are older married
couples without children. Only 20% of all families interviewed in the study
had children living at home.

Welfare and pensions were the second highest source of income in the
county, but made the lowest contribution to average rural family income.

Almost 70 percent of the men doing farming would be willing to make
basic changes to improve their efficiency.

More than 300 of the rural families would be willing to move outside
the county to find employment.

Seventy percent of all rural residents earned less than $2,500 from all
sources in 1955.

Authors of the report comment: "In summary it might be emphasized
that the rural problems in Choctaw County cannot be solved in agri-
cultural endeavors alone. Industrial opportunities must be found by those
who are willing to do productive work and cannot be employed profit-
ably in farming. The people, especially the youth, should be advised of
the county problems and encouraged to train for jobs that will offer them
the best advantages in nonfarm work as well as in agriculture."

Here are highlights of a report from Hardin County, Tennessee, based
on a preliminary survey made soon after the county came into the pro-
gram last year:

"Originally the county produced cotton, corn, and livestock, but in
recent years an attempt has been made to shift to other cash income
crops."

"Fifty-two percent of the county is made up of timber lands which
have been ruthlessly slaughtered with little attempt at selective cutting."

"The general health and sanitation in Hardin County are substandard.
Only about twelve to fifteen percent of the rural homes have inside toilet
facilities."

"Malnutrition among children in the county is widespread."

". . . present problems are of a wide variety in nature ranging from use
or abuse of our resources to a general attitude of apathy and lack of in-
terest, among some of our low-income families, concerning their own
situation."

"The immediate approach to the solution of our problem requires the
closest-knit integrated program, designed to bring together the combined
efforts of all who have a part in helping to solve the problems of the low-
income and nonfarm workers."

III

We have gone far enough in this program to encounter some of the major obstacles. I should like to enumerate ten of them.

1. Farm people with low income, especially the older ones, are likely to be somewhat apathetic about this program. Some of them have lived so long under restricted opportunity that they no longer aspire to improve their economic condition. They are "adjusted" in the sociologist's meaning of the term. They do not respond well to the conventional ways of doing extension work. They do not come to meetings.

It can be argued that the public generally has an interest in this problem, in addition to the interest of the individual. The nation's productivity, its defense, its health, its education, its governmental costs and revenues are all concerned. Thus there is both individual interest and group interest in improving economic conditions in rural areas of low income.

How do you motivate these people?

Or, as those who dislike the program will say, should they be motivated? Why disturb these happy people? Why give them ulcers, like the rest of us have?

One can argue, with justification, that many of them do aspire to improve their condition, especially the younger ones. Although some are happy and content with their present lot, others, even the older ones, will respond to opportunity when it is presented. However it may be with the older folks, the young people deserve to know that life can mean more to them than it did to their parents.

In any case motivation will be a problem. Who should be motivated, and if so, how?

2. These people are not well organized. They have little influence with appropriations committees. Their spokesmen are few. Consequently, their needs are less likely to be voiced and less likely to be met. Public recognition for work well done is less likely to result from activities in behalf of these people than for some other groups.

3. Consideration of off-farm opportunities for these people, which is important in the solution of their problems, will encounter a deep-seated and widely-held belief sometimes called "agricultural fundamentalism." This belief, which we have all encountered, looks askance at any movement of people out of agriculture, which must be a part of the solution.

It is well to recognize the merits of rural living. I am sure all of us do so. The difficulty comes when these merits are rated so high as to justify what amounts to rural slums. Understanding of this complex of problems will be required in working with the Rural Development Program. How to help people weigh the known merits of rural living in the light of a wide range of opportunities—this will be the challenge.

4. In some areas, employers of rural labor will be satisfied with the status quo. There will be some people who will not be happy with a program that might reduce the supply or raise the returns to rural labor. Others will maintain that the Rural Development Program may further increase the already burdensome supplies of certain farm products.

5. In some industrial areas, established labor groups will not be enthusiastic about the entry of these rural people into the urban labor force.

6. Education is obviously one of the solutions to the problem. But in many cases those local areas that have greatest needs for more education are least able to afford it. Thus federal aid to education, in one form or another, enters the picture. This is a thorny and controversial matter. The Rural Development Program will take careful handling so far as this issue is concerned.

7. Twenty-four percent of the rural farm population in the generalized problem areas is nonwhite. To the degree that any problem is affected by race problems, it is thereby complicated.

8. It will be difficult (but desirable) to avoid designating a particular group as "low income" people. Particularly, it will be difficult (but desirable) to avoid splitting the Extension Service in two—one part to handle the needs of commercial farmers and the other part meeting the needs of low-income farmers.

9. In this program various departments of government are cooperating, as well as various branches of the Department of Agriculture. The philosophy and the manner of organization differs somewhat from one agency to another. It will be difficult, but highly important, to keep these various agencies in step, working on a coordinated program.

10. Personnel assigned to this program will have special requirements. Knowledge of people will be no less important than knowledge of agriculture. Finding people qualified to do justice to this job will be a tough job.

In the light of these considerable difficulties, prudence will be needed, as well as zeal. It will be well not to promise too much too soon.

Nevertheless, the program is one of real substance, one of great promise.

Those of us who have worked on this program—and I think now that I am speaking for most of the people who have had experience with it—came to a growing conviction that this program cannot be wrong.

It can not be wrong because it will help people achieve the goals to which they themselves aspire, and surely the people themselves are not wrong.

It can not be wrong because the types of changes envisaged by the

program are already under way; the program would merely expedite them. We will be working with, not against, basic economic forces.

It can not be wrong because practically every research study addressed to this problem has produced results that support the general direction the program has taken.

The main thing that might cause this program to fall short of its promise is that we may organize it improperly or weaken in our resolution to push forward on it. This must not be allowed to happen.

APPROACHES TO THE RURAL DEVELOPMENT PROGRAM*

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THE purpose of the rural development program is to help "families on small farms with limited resources to attain greater opportunities in an expanding economy."[1] The program recognizes that a large number of rural families have not shared the fruits of the economic progress of the past two decades and points out the need for developing the resources controlled by these families in order that they might make a greater contribution to the national product and thereby increase their real incomes. This is a noble objective. For a long time, economists have pointed out that low-income farm families are concentrated in certain geographic areas, and that the agricultural programs receiving the bulk of federal funds could not be of much benefit to these families.

In a sense, then, economists should be jubilant over the creation of the rural development program. It is a program of economic and social development. The desirability of economic development is unquestionable. This jubilation, however, may be of short duration. The cause for concern lies in the fact that through the program, it is expected that the rate of economic development will be increased. Like all other programs, however, what will be accomplished by the rural development program will be determined largely by the means used in carrying it out. Economists face the challenge and must accept the responsibility for seeing that means used in carrying out the program are consistent with the attainment of the objective of economic development. The purpose of this paper is to indicate the general nature of the problems against which the rural development program is directed and to discuss the appropriateness of alternative methods in carrying out the program.

The Problem Implicitly Assumed in the Program

Implicit in the rural development program is the basic assumption that the current low incomes of farm families are the result of inefficiency in resource use. The title of the report from which the rural development program stemmed, "Development of Agriculture's Human Resources," implies that human resources of farm families with low incomes are not being employed in accordance with their economic and social potentialities.

[1] *First Annual Report of the Secretary of Agriculture,* September, 1956.

Inefficiency in the use of resources may be considered from the point of view of given amounts and productive capacities of human and other resources in agriculture or from the viewpoint of variable amounts and productive capacities of resources. The first case is a short-run problem. It involves the allocation of given resources among uses in accordance with the concept of marginal opportunity return. Conceptually, the problem is one of movement along a production possibility function until welfare is maximized. This approach is frequently used in farm management.

The second case is more general, including the first case, and treating the amounts and productive capacities of resources as variable. In addition to improvements in welfare resulting from movement along production possibility functions, the economic development problem is concerned with movement of the functions. The productive capacity of resources gives position to production possibility functions. Therefore, in the economic development problem, the productive capacity of resources is not taken as given but becomes a part of the problem. Investment in the human agent and in other resources represents uses for capital in the same sense as current income-generating uses. Time is important in this case, and the allocation of resources to resource development and to other uses depends upon the rates at which resource owners are willing to substitute current and future income.

It is clear that the rural development program is concerned with resource development, i.e., with increasing resource productivity and obtaining more efficient use of resources over time, as well as with finding more productive uses of resources currently in rural areas.

Sources of Inefficiency

Before turning to a discussion of approaches to rural development, the sources of inefficiency should be examined. If the low incomes of rural families are due to underdevelopment of resources, the causes of this underdevelopment must be identified and removed if the rural development program is to be successful.

There are three major sources of economic inefficiency in resource use. Two of these stem from imperfections in the operation of the market economy. The other source involves the choice of goals in resource use.

Economists generally treat individuals or families as decision-making units pursuing known objectives and thereby contributing to social welfare. Accepting rationality implies that the individual will use his resources in such a way as to maximize his welfare, subject to his interpretation of the conditions under which he makes decisions. From the standpoint of the individual and his expectations, therefore, inefficiency is inconsistent with the rationality postulate.[2]

If we accept the sovereignty of resource owners and assume rationality

in action, inefficiency from the standpoint of the resource owner can result from only two conditions. Either (1) the resource owner lacks knowledge regarding resource productivity in alternative uses, or (2) there are institutional restrictions on resource mobility that impede transfer of resources among uses.

The effects of lack of knowledge on resource use are obvious. Resource owners always make the best decisions, from their viewpoint, given the knowledge at hand. But they cannot be expected to make "correct" allocative decisions without knowledge of the consequences of their decisions. The desire of resource owners to obtain information relative to resource productivity and the obvious fact that "correct" decisions are unlikely to be made without "correct" information undoubtedly account in large part for the emphasis placed on firm analysis by agricultural economists.

Even if resource owners have perfect knowledge in regard to the earnings of resources, they may still be unable to transfer resources freely among uses because of institutional restrictions on mobility. This is a second source of inefficiency in resource use. For example, imperfections in the capital market may restrict investment in the human agent and also may prohibit owners from transferring labor resources to their most productive and preferred uses.

The third source of inefficiency in the development of human resources involves the choice of goals in resource use. The rates of substitution of monetary and nonmonetary returns differ among individuals. Thus, even though income expectations, capital limitations, and effective rates of interest are identical, individuals may still choose different uses for their resources because of differences in the values they place on monetary and nonmonetary returns. When national income is used as an indicator of social welfare, only goods and services that are sold through the market are considered as contributing to welfare. On the basis of this criterion, therefore, individuals who place a high premium on nonmonetary returns are said to use their resources inefficiently. Clearly this represents a conflict of values between the individual and society.

In summary, there may be three broad general causes of underdevelopment of agriculture's human resources. These are (1) lack of knowledge of resource returns in alternative uses; (2) institutional barriers to resource mobility; and (3) a high rate of substitution by farm people of monetary for nonmonetary returns from resource uses.

Approaches to Rural Development

Let us now turn to consideration of approaches to rural development. The approach considered most appropriate obviously will be affected by

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² Source: C. E. Bishop, "Underemployment of Labor in Agriculture in the Southeast," *Journal of Farm Economics,* Volume 36, May 1954.

one's interpretation of the problem. My position is that the over-all goal of the rural development program should be economic development from a national viewpoint.[3] Emphasis, therefore, should be placed on people and their welfare, not upon agriculture as an employer of resources. The problem should be viewed as one of isolating the most productive uses of resources owned by families living in rural areas. The current residence and use of family resources should be considered only as a basis for defining the population for study.

Three approaches to the rural development problem are likely to be used. These include: (1) providing local people with descriptive information concerning current incomes and resource control; (2) farm management analyses describing income possibilities for various farm situations; and (3) a broad over-all approach to economic development. Let us consider each approach briefly.

Providing Descriptive Information to Local People

Certain phases of the rural development program are locally oriented. The very essence of the program lies in the fact that geographical pockets exist in which human resources are underdeveloped and that some action is desirable on the part of the public to promote the development of these resources. In the handbook, "Development of Agriculture's Human Resources," one of the procedures suggested was for county and community program development committees to be organized to consider the total problems of the area and what could be done about them. The report suggests the possibility of establishing local planning units for areas even smaller than a country. Also, the handbook states that "aid will be used to help families in working out plans in line with their own resources and their own values."[4]

The assumption underlying the locally oriented approach is that the low incomes result from the fact that local people do not know what their incomes and resources are. It assumes that these people will be able to find solutions to their problems once they know how their incomes in relation to their resources compare with those of people in other areas. This approach also assumes that no conflict in values exists. It assumes that bringing people together in a body to describe and discuss the existing situation will in some miraculous manner motivate them to take action to improve their situation. Perhaps of even greater significance, however, is the assumption that knowledge is at hand concerning which action should be taken once the existing situation has been described. It seems more

[3] C. E. Bishop, "The Origins and Policy Implications of Low Incomes Among American Farm Families," *Hearings before the Sub-Committee on Low-Income Families*, Washington, D.C., November 1955.

[4] *Development of Agriculture's Human Resources*, USDA, p. 18.

reasonable to believe that the local people are aware of their low incomes but lack information concerning ways of increasing their incomes.

There are obvious dangers in a locally oriented approach to rural development. Perhaps the greatest of these is the fact that the knowledge of local people is likely to be very restricted in terms of possible solutions of the problem, especially those solutions involving the transfer of resources outside the local vicinity. The best opportunities for increasing the incomes of families in some areas quite likely will involve a transfer of labor from these areas. A locally oriented approach to the problem, however, is likely to place emphasis on local self-sufficiency and to lose sight of the broader market opportunities.

Farm Management Analyses

A second approach to rural development involves description of the effects of within farm changes in resource use on income possibilities. The individual economic unit analysis used in the farm and home development program uses this approach. The rural development program, however, is not a farm management program. In the program there seems to be no intention that farm firms should be analyzed solely as going concerns subject to the quantities of resources currently on the farms. This approach is generally used on the assumption that the family is going to continue farming. Most economists will quickly admit, however, that a transfer of labor to nonfarm employment likely will be necessary to attain most efficient use of labor from low production farms.

Another major weakness of the farm management approach is that it usually abstracts from aggregative effects of changes in production. If budgetary and linear programming procedures are to be used, the analyses should concentrate on resources required to obtain specified income levels and should be carried at least far enough to indicate the manner in which changes in factor proportions on farms and changes in prices of farm commodities and inputs affect income possibilities. Also, the bias that farm management workers have had against nonfarm employment should be removed, and nonfarm employment should be treated in the same manner as other uses of resources. As a minimum, information should be supplied relative to the quantities of resources needed to yield resource returns in agriculture comparable to those that may be expected in nonfarm employment in the near future. Even this approach loses much of its significance, however, unless information is provided to the decision maker relative to the probable levels of prices for farm commodities and inputs in the near future, and unless information is available on market conditions for nonfarm employment. These types of information must come from the industry level. Hence we are forced to consider a broader approach to economic development.

A General Approach to Rural Development

In evaluating opportunities for large numbers of low-income families within agriculture, information on future supply and demand conditions for agricultural products is needed. As Professor Schultz has pointed out, we have reasonable confidence in our knowledge in regard to the demand for farm products, but know very little about the supply of farm products.[5] He correctly states that much of this uncertainty in regard to supply stems from inability to predict technological change and to determine its effects. His analysis indicates that between 1930 and 1950 only 4 per cent of additional output of agricultural commodities in the United States could be accounted for by additional input.

The same general conclusion seems appropriate with respect to the total economy. Terborgh has estimated that most of the recent increases in United States production have been due to improvements in technology.[6] His estimates indicate that in constant prices the ratio of private output to input in the U. S. has increased since the 1920's, and was stable during the two decades 1900-1920.

If we examine the effects of changes in technology on agricultural production, we find that they increase the opportunities for employment of skilled labor in agriculture and decrease the opportunities for unskilled labor. The same effect may be noted in other parts of the economy. We may conclude that technological changes are likely to increase the necessity for additional technical training of labor if the income potential of persons living in low-income areas is to be realized.

This brings us to another major obstacle that must be overcome in rural development planning. We know little about the demand for labor in nonfarm employment, especially how it is likely to change in the future. One of the objectives of the rural development program is to promote expansion of industrial employment in low-income areas. We need more information concerning the effects of local industrial development on the level and distribution of income to and within agriculture. Also, we need information in regard to economies of scale in industrial firms. Purely local emphasis on industrial development may place industry in the same general poor economic conditions that small farms are in currently. Emphasis on local industrial development is likely to encourage expansion of small firms using relatively little capital per worker. Small firms located in rural areas may face extremely difficult competition in the future unless they are developed on a sound economic base. Many of these firms face

[5] T. W. Schultz, "Reflections on Agricultural Production, Output and Supply," *Journal of Farm Economics*, Volume 38, 1956, No. 3, pp. 748-763.

[6] George Terborgh, Machinery and Allied Products Institute, *Capital Goods Review*, No. 22, May, 1955.

essentially the same demand and supply conditions as farms. Furthermore, the productivity and wages of labor in low-capital firms typically are low. If local industrial development becomes an end in itself, it may lead to shattered hopes and perpetuate inefficient resource use.

There is one other point that should be discussed briefly. This is the preference problem. Concern over conflicts of preferences must come from the fact that the national income is decreased by cultural impediments to resource transfers. For obvious reasons the preference problem is likely to receive little open discussion. There are two major types of action that can be taken to combat the preference problem. Given preferences, the conflict can be reconciled only by regulation or arbitration. For example, low-income areas could be zoned and the people moved from these areas. Or, the people could be drafted for work in employment generating higher income. Such programs are not looked upon favorably by the American people and are likely to be used only in times of emergency.

Over the long run, however, preferences of individuals need not be taken as given. Conflicts of preferences can be removed by changing the preferences of individuals. This can be accomplished through education and through subjecting people to new experiences. Positive action to alter the values of people rests on the willingness of one to assume the position that there are superior sets of values and that particular environments exist that are consistent with the acquisition of these superior values.

Alteration of the values of people is a long slow process, however, and quick results should not be expected. Furthermore, the forces leading to alteration in values are not likely to stem from the small local areas in which the rural development program is now being conducted. The forces must come from a larger area where the need for a "better" educational program is recognized and identified with majority opinion.

In closing, I would like to say that the rural development program is different from most other public programs in that the educational agencies are expected to accept a major role in the development and implementation of the program. It is essentially a program of economic development, with attention focused on a particular segment of the population. Economic information and an economic orientation are essential to the success of the program. As I have pointed out above, much of the information needed in the development of the program is not at hand. The program must be based in part on the judgment of educational workers. Economists must accept the challenge presented by the program and provide guidance to the economic phases of it. Furthermore, we must recognize that the types of problems against which the rural development

program is directed are always with us. We must anticipate a continuing need for economic information and accept the responsibility for obtaining the information needed in guiding economic development.

DISCUSSION: STATUS OF THE NATIONAL RURAL DEVELOPMENT PROGRAM TO DATE

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Since I haven't seen Mr. Paarlberg's paper, I will do what I would probably have done anyway—namely, comment on the ideas behind a rural development program, some of the difficulties in carrying it forward, and some things that could be done to improve it.

I

The concept of a rural development program is fully as sound as anything presented for agriculture by this or any previous administration. And it does not detract from the merit of our current broad concept of rural development to admit that we sort of "backed into" it by way of our efforts to do something of value for low-income people in rural areas.

The first idea accepted was that the improvement of the situation of low-income families is not in any major part to be found within the existing alternatives of the families themselves. For many farm families with low income, even to hold their own, a much larger share of nonfarm income is required. Thus their solution lies for the most part outside of agriculture—in nonfarm employment opportunities, high-level employment and stability of income and purchasing power. This, of course, is an idea that economists and agricultural economists have for sometime been posing as an important one in agricultural policy. It has, for obvious reasons, gained slower acceptance as a functional part of the programs of such agencies as Soil Conservation Service, Farm Credit Administration, Agricultural Stabilization and Conservation, and Agricultural Extension.

The second idea basic to the program is that the price system by itself cannot be relied upon to produce the adjustments necessary in sound rural economic development. To contradict this statement would be to deny the need for a special rural development program. But clearly this new thinking has struck a body blow to the concepts of any agricultural economist who depends upon the comforting notion that the market place is sufficiently sensitive and rational in its allocation of resources. We find circumstances casting serious doubts both on the adequacy of the market place as a mediator and on the speed and ease with which individuals adjust to its "judgments."

The third idea is that the will of groups of people is one of the primary forces for and perhaps even a major guide to economic development. Quoting from the Rural Development Program Guide, "The rural development program is designed to encourage local people and their leaders to give direction and provide the initiative for area economic development."[1] This idea forces attention to the process of group action—group judgment, decisions, and program administration. If economists are to play their full role in this process they will have to add to their "economic analysis" an understanding of how economic decisions actually are made by groups. This involves political, social and economic organization. In short, it suggests that we try to develop in our field more of the concepts suggested by the term "Political Economy."

II

There are a number of potential pitfalls in the specific rural development program under consideration today.

1. As the program has been operated to date it has been limited to rural areas that have substantial numbers of families with low incomes. But none of the methods or approaches suggested so far is of narrow application only to areas of low income. On the contrary, the elements of soundness in the program to date are those of any adequate program of economic development for any county or region. The "low income" approach prevents activities in many regions where substantial progress might result from small effort. I believe it is a mistake to let rural development become identified as a low-income program. I believe it is almost as great a mistake to give the program a name or orientation which sounds as if we believe "rural" development can be considered by itself. Emphasis should not be limited to areas of low income. And it cannot even be limited to "rural" areas, since the program once underway must also include urban people. This point is quite widely recognized. In Wisconsin, for example, we speak of the community or county resource development program. Whether in practice we live up to the broader approach implied by this broader title is the vital question we will continue to face.

2. The same fallacy that led us once to believe that the solution for the individual farmer's economic problems invariably lies in his own hands may be equally dangerous when applied to a rural community. Those engaged in rural developmental activities have long recognized that there are very serious problems in relating the changes in their communities to the economy of the state, of the nation and even the world.

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[1] Rural Development Program Guide, U. S. Department of Agriculture, November 1956.

The solutions to problems of a low-income community seldom lie entirely within the community. To be sure a community should make full use of its resources. However it is plainly not safe to accept the judgment that a new industry or new employment is automatically a good thing for any community. Conceivably it might only postpone and make more difficult an adjustment the community ultimately could not escape.

3. Partly because the USDA has assigned leadership for this program to the Extension Service, the emphasis has seemed to be on education and planning as the chief resource to be employed in rural development (this despite the fact that many other agencies share in the program). Education and planning are not enough. People who seek information and who plan also want action. Local resources will more often than not be inadequate to carry out a sound community development program. The action side of the rural development program has not received adequate attention. If it doesn't in the future, the result may be an unearned black mark for education and in particular for agricultural extension. State and federal programs need to be more flexible if they are to give full support. The change in the Farmers' Home Administration's basic legislation to permit loans to part-time farmers is one illustration of the type of changes that must be made.

4. One major phase of the rural development program is assistance to farm people with low income in their efforts to get adequate farm units and to farm and live better. This has been the basic program of agricultural extension since its beginning in 1914. It has been fortified in the last few years with a much expanded program called "Farm and Home Development." Major organizational problems have come out of the attempts to determine the responsibilities of the farm and home development agents and their relationship to the ongoing extension program. Now with the identical activity a major part of the rural development program, there is almost hopeless confusion in too many places. Farm and home development programs represent no major revision in the philosophy of agricultural extension work. Rural development programs are for many states an entirely new approach. There is a danger that the resources of the rural development program will be used primarily on farm and home development and the important new concepts of rural development will not be used. This is only one of the reasons for keeping the two separate in our thinking, if not in their operations.

III

Some things to consider that might improve the program. The general nature of any suggestions I would make are indicated by the previous comments. Here are somewhat more specific suggestions:

1. Efforts to reorient the vocational agriculture program toward "training rural youth" rather than "training boys to farm" should be continued and intensified.

2. The employment services should be expanded to furnish information to low-income people about employment opportunities. This has been visualized as part of the program, but Congress has not seen fit to make the appropriation.

3. The President recently established a public works planning organization. In the announcement was the call for state and local public works planning groups. It seems to me the rural development groups would be the ideal vehicle to determine many needed public works. In addition to investments in natural resources, such a public works program might well concern itself with schools, hospitals, and highways. These are the main things that local communities will not have adequate resources for.

4. Major revisions in the "soil bank" will be necessary if the federal government is to spend 1.2 billion dollars next year when only a small proportion of Corn Belt and dairy farmers will be eligible. I suggest using a part of these soil bank funds to carry out plans of rural development groups which cannot be handled through local resources and which involve community or group action. For example, a community could then plan and develop a forest rather than as now have its individual farmers plant isolated tracts of three-plus acres to trees. It seems to me that only then would we actually be doing the type of thing which brought such widespread popular support to the idea of the soil bank.

The rural development program is based on some very good ideas. It is facing some serious difficulties. It has possibilities of becoming a strategic part of a most important economic development program for the whole economy, not simply for rural areas.

DISCUSSION: APPROACHES TO THE RURAL DEVELOPMENT PROGRAM

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Professor Bishop has criticized the approaches in the rural development program on three major counts: (1) a local rather than national orientation, (2) an overemphasis on agriculture and a consequent underemphasis on nonagricultural development, and (3) an unrealistic presupposition to the program that sufficient knowledge exists for local planning and development. The first two limitations were derived as implications of the equilibrium conditions of micro-static economic theory. The third criticism is

based upon a judgment regarding the state of our economic knowledge on the low-income problem.

Although I agree with Professor Bishop that these are important limitations to current approaches in rural development, I cannot agree entirely with his reasoning in deriving these limitations. Also, I believe he de-emphasized one important obstacle, namely, the problem of values and attitudes in low-income areas. The attitude and value situation in those areas may limit the actual effort put forth in a local rural development program.

Fortunately, in economics, we have a theory or frame of reference useful in diagnosing many of our problems in resource allocation and in working out solutions therefor. In general, an insufficient use has been made of this micro-static theory in our past economic studies. However, it is possible to misuse this theory in handling problems in economic dynamics or problems not entirely economic in character. I believe Professor Bishop at times made this error in his reasoning. His procedure, not unique in our science, was to relax the assumptions underlying the micro-static theory to admit a situation containing lack of knowledge, restrictions on the movement of resources among alternative uses, and values inconsistent with the income incentives regularly assumed in economics. Then he implicitly identified the elements of inefficiency in the low-income situation with those variables our theorists have been able to integrate into our static analysis under the condition of relaxed assumptions. These elements were (1) errors in prediction of future events or economic uncertainty, (2) restraints of an institutional or policy nature, and (3) reduced income earning incentives because of the leisure motive. Empirical studies in more advanced areas of our economy have been influential in recent developments in micro-static theory, and, it is possible, Professor Bishop's reasoning may explain adequately existing inefficiencies in resource use within those areas. However, the variables associated with inefficiency within our higher income areas are not necessarily the appropriate variables to use in explaining inefficiency in low income areas.

Obviously, we need a theory of economic development that will explain differential rates of growth within our economy. We do not have such a theory adequate for use as a frame of reference in research on the low-income problem, or for use as a guide for planning rural development programs. This, it seems to me, is the major limitation to the presupposed adequate knowledge for planning rural development programs. I believe an adequate theory for this purpose would contain variables usually excluded in our more conventionel explanations of economic inefficiency. In particular, I do not believe our conventional reasons for economic inefficiency, namely, economic uncertainty, institutional restraints, and lei-

sure motives of entrepreneurs, encompass the full range of theoretically possible reasons for inefficiency in resource use within our economy. A more dynamic theory than contained in statics or comparative statics is needed for use in determining the reasons for existing inefficiency in resource use in low-income areas.

In a low-income area I am studying in Eastern Oklahoma, there has been a major decline in the proportion of rural households engaged in farming as a major occupation during the past two decades. Presently, only one-third of these households are bona fide farmers, i.e., produce $250 or more in value of farm products for sale. This is a shift from cotton-corn-subsistence farming to a farm economy of primarily small cattle-production units. Other rural residents are retired, semi-retired, disabled, or engaged in nonfarm work with varying degrees of underemployment. Half of the bona fide farmers are part-time farmers, i.e., they work the equivalent of 100 days or more off their own farms. A general lack of interest exists in the development of farming as a major occupation, either in present types of production or in new types of production. There was a general lack of knowledge on how farm incomes could be increased in types of farm production other than that in which they presently are engaged. Alternatives in types of farm production for the area presently are limited by the nature of the resources, available markets, and available knowledge. Farm production practices vary but little among the farms, and a high degree of homogeneity exists among the farmers in knowledge of production practices and farm investment opportunities. Differences in value of products produced per farm among the bona fide farmers depend primarily on scale of operations and character of the land resources. Actual application of farm technology lags behind farmer knowledge. For example, 90 percent of the farmers believed the application of fertilizer on row crops and on small-grain crops would pay, but only one-third of these have adopted the practice. Capital rationing is a possible reason for this lag. Only one-third of the farmers had contacted the county agent, or one of the other agricultural workers in the county, during the past year. The majority of these contacts were not to seek information, but rather to obtain a tangible service, such as soil testing, digging a pond, doctoring a sick cow, etc. The majority of the farmers were indifferent to the information type of service rendered by local agricultural workers.

Obviously the area I have described is not typical of all low-income areas—it probably is an extreme case. The problems of limited knowledge, attitudes and values are interrelated in this area, but perhaps the attitude and value problem would be predominant in any locally oriented development program with an emphasis on agriculture.

This value and attitude problem is not due primarily to a leisure motive. I believe the major source of the lack of strong incentives to increase income arise from their accustomed standards in consumption. That is, values of the people are poverty oriented, and their levels of living never have varied enough to greatly influence this orientation. The level of consumption in the area of my study is higher than 10 or 20 years ago, but the difference is mostly in electricity and electrical appliances. The needed cash to cope with the increase in cash living costs has been obtained through increased nonfarm work by rural residents in the local area and seasonal work outside the local area.

The employable nonfarm rural residents in the area of my study desire and are willing to work full time provided local work is made available. Furthermore, they are willing to work in the local area at about one-half the wage rate desired for nonlocal employment. Quite largely, this labor force is unskilled, and would be rated by industry as low in quality. Education obtained by present employable nonfarm rural residents averages slightly less than 8 years, as compared with an average of 9 to 11 years of schooling obtained by those who have migrated from the area. This labor force of low-productivity workers may have limited alternatives in employment outside the local area unless measures are taken to increase the skills and abilities of these people.

In my study area, the solution to the low-income problem is not entirely one of transferring resources out of agriculture. This already has and continues to take place. Rather, the major problem is to transfer the excess labor resources out of the area. As Professor Bishop has emphasized, the current approaches in rural development do not attack this problem. Local rural development leaders do not want an out-migration of their most productive people. Their efforts, therefore, will be mainly to create farm and nonfarm income opportunities in the local area. As scientists, we are not prepared to tell them how this can be done. Also, we could be of little help if the local effort were directed toward moving people to other areas for employment. Professor Bishop stated we do not know what the long-run demand for labor will be in the more developed areas of our economy. Also, we do not know how to overcome the resistance of families with low income to moving to areas having higher income. Currently, public education is our only publicly acceptable way of attacking the kind of value and knowledge problems existing in low-income areas. I believe the major knowledge problem of people in areas of low income is limited perceptions of reality, and combined with this problem, is an image of reality skewed by the major beliefs and values of their culture. If we want a program to develop agriculture's human resources, increased public support of education in areas having low income may be the most feasible way to get the job done.

AGRICULTURAL POLICY—RECENT CHANGES AND FUTURE IMPLICATIONS*

Chairman: Karl Brandt, Stanford University

AN APPRAISAL OF RECENT CHANGES IN AGRICULTURAL PROGRAMS IN THE UNITED STATES**

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I

I WANT to do two principal things in this paper: First, *describe* the general position of this Administration with respect to participation in, or involvement in, the agricultural sector of the economy. This I shall do with respect to three lines of governmental action: (1) price supporting activities, (2) surplus disposal and new market activities, and (3) production control activities. Second, *appraise* current and prospective developments in each of the above lines of governmental action. In fact, then, this paper breaks into four substantive parts: (1) a description of government in agriculture as of 1956-57, (2) an appraisal of the parity idea in price supporting actions, (3) an appraisal of surplus disposal activities and the development of new markets, and (4) an appraisal of production control activities.

II

In spite of the well-known attitude of this Administration with respect to government and business and the torrent of words that have flowed out of the U. S. Department of Agriculture in recent years with respect to the desirability of getting government out of agriculture, it seems clear that there has been no lessening of governmental action in, or with respect to, agriculture in the past several years. Stated positively, and more specifically, if accurate weights could be assigned to governmental actions taken to support prices, to dispose of surpluses and to control production, the index of government involvement in agriculture would be as high in 1956 as it was in 1952. One thesis of this paper is, then, that the *level* of governmental involvement in agriculture is undiminished, and that it may well increase in the years immediately ahead.

Turning first to governmental actions resulting from price supporting

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commitments, we are all aware that this Administration attaches great importance to the idea of flexible price supports. Many of us, also, may be aware that this Administration has flexed prices downward on the so-called "basic" commodities to around 82.5 per cent of parity, and there the flexing seems to have stuck. And in the case of butter, the level of price support, which once was down to 78 per cent of parity, is back up to 81 per cent. But important for this discussion, the level of price support has not been lowered sufficiently for any of these commodities, since the inception of flexible price supports, to reduce production, hence get government out of the price supporting business.

On the contrary, one might argue that levels of price support on the "basics" have been lowered just enough to irritate farmers. The result is that farmers have tried to increase production and government acquisitions have been greater than they otherwise would have been. In the case of corn, for example, where production controls have been ineffective, CCC stocks have climbed from approximately 438 million bushels in October, 1953, to 906 million bushels in October, 1956. In the case of wheat, where controls have been more stringent, and where strenuous efforts have been made to dispose of stocks, CCC holdings of wheat climbed from 428 million bushels in October, 1953, to 913 million bushels in October, 1955, and have fallen to only 850 million bushels as of October, 1956.

But whether lowering the level of price support a few percentage points has increased, or whether it has decreased, the volume of USDA operations is irrelevant to this discussion. The important point to be made is that *the downward price flexing that has occurred has failed to get government out of its price supporting role to any important degree.*

At the end of March, 1956, the investment of the CCC in price supported commodities amounted to $8.7 billion.[1] This was an increase of nearly $1.5 billion over March, 1955. And this increase took place at a time, when, I think it is safe to say, USDA officials were working harder at disposing of government stocks than ever before in history. For the period, July 1, 1955, to July 1, 1956, over-all disposition commitments ran close to $1.75 billion, of which well over $1 billion was with foreign countries.[2] This represents an increase of some 15 per cent over the previous fiscal year 1954-55, and a very great increase over the level of surplus disposal in 1952 and 1953. Further, the tempo of surplus disposal has stepped up since July 1, 1956.

Of course the present heavy surplus disposal operations are the inevitable result of price supporting actions as they have developed in the

[1] *The Demand and Price Situation*, USDA, DPS-17, May, 1956, page 12.
[2] *Ibid.*

United States to this time. The fact also remains, however, that the federal government has entered into the distribution of agricultural products on a scale heretofore unknown. The USDA is donating food supplies to schools, public and private institutions and needy persons within the United States; it is making donations abroad; it is selling agricultural products for foreign currencies; it is making emergency relief shipments; and it is entering into barter arrangements. In sum, the USDA is using every disposal device that has shown promise, with one important exception, for getting rid of CCC stocks. A whole new dimension in government participation in the economy has been opened and is being exploited.

Some may argue that the present large and wide-spread surplus disposal operations of the USDA are not the result of a conscious policy; such operations, they may argue, are the last and inescapable act in a sorry drama of price support. But such an argument cannot be made with respect to the soil bank scheme for controlling production. This Administration tore the soil bank idea from the halting hands of the Democrats and made it into a major instrument of its agricultural policy.

Acreage controls and marketing quotas were not reducing aggregate output. This was clear. These devices were simply shunting agricultural resources from one commodity to the next. Hence, this Administration superimposed the idea of the soil bank onto the existing structure of production controls to reduce *aggregate* output. Due to considerable political maneuvering on the part of both parties, the program did not go into operation in 1956 until planting plans and farm operations were well advanced in most areas. Hence, the program had little chance of success in 1956. But even so, 550,000 agreements were signed with farmers, involving 12 million acres with compensations amounting to $161 million.[3] And it is expected on all sides that the program will triple, or quadruple, in size in 1957. Certainly, the Administration is depending upon the soil bank to reduce over-all output in 1957.

Without venturing any appraisal of the soil bank idea at this point, it must be concluded that government involvement in the economy was increased moderately in 1956 and will be increased importantly in 1957 by reason of this program. Considering the continuing purchase and loan operations of the federal government to support prices, the greatly expanded surplus disposal activities, and the evolving soil bank program, I am driven to two conclusions. First, government involvement in the agricultural segment of the economy has not decreased during the past four years. If anything it has increased. Second, the degree of involve-

[3] Earl L. Butz, *Your Balance in the Soil Bank,* paper read before the Middle West Soil Improvement Committee, Chicago, Ill., Oct. 25, 1956.

ment is likely to increase, and perhaps importantly, before it may be expected to diminish.

But the cynic may say—"You are wrong." Once the election year is passed, the Republicans will pull government supports out of agriculture. Now there is no question in my mind but what this is what the Grand Old Party would like to do. But it can't. No political party can. The economic, hence the political, consequences are too great and too disastrous.

In the first place, flexing the levels of price support down a few more percentage points will not get the government out of the price supporting business. No one knows how low support levels would have to go, but they would have to go much lower and stay there a long time to bring production back into line with demand. In the second place, no political party in modern times could live through the social and economic unrest that the above action would entail. This Administration in lowering price support levels to the neighborhood of 82 per cent of parity has reached the lower limits of political tolerance with respect to farm prices.

The plain facts are that in agriculture this Administration has, and any other Administration would have, a bull by the tail. The combination of three circumstances make it impossible for government to get out of agriculture. These circumstances are (1) extremely low price and income elasticities for farm food products, (2) the ubiquitous technological drive to increase output on 3 million commercial farms, and (3) the democratic ethic of reasonably fair incomes for all members of society.

III

The idea of a fair price, or an equitable price, or a parity price, that farmers, or any other group for that matter, ought to receive through some sort of purposive action, is criticized by many people in our society, and by orthodox economists in particular. The criticism seems to run at two levels: First, there is denial that a useful, workable, concept is possible. Second, there is the disparagement of overt measures as being "political"—the presumption being that something political is something bad.

Turning first to the political argument, it seems reasonable to ask—if society desires to define in measured terms a fair price, how is this to be done in our society, if not through democratic political processes. I do not think many of us would want to leave the job to one man, to a private interest, or to a government agency. Personally I would not want to leave the job to Secretary Benson. Neither would I want to turn the job over to ex-Secretary Brannan. The biases of both of these men, or their principles if you will, run too deeply to suit me. And certainly we realize that the old BAE and the new AMS do not have any superior

analytical methods, or measuring rods, that enable them to say what a fair price for hogs may be. They do not because, although the concept of a fair price is ever present, it is a subjective thing that does not lend itself to a unique solution in measured units. This is an equity question— a question of what constitutes fair treatment to one group in relation to other groups—and we leave important questions of this sort to the Congress. We do this because in Congress the interests of all are represented, and it is there that machinery has been established to compromise and reconcile interests, and to effect collective decisions tolerable to all concerned.

Persons who criticize the parity idea and the parity goal in the United States as being political, either do not understand the nature of the problem or the purpose of government in a democratic society. If society is desirous of farm people receiving fair, or equitable, prices, what we want is more politics in the determination of those fair prices—in the sense of all interests being represented, more debate, a consideration of all viewpoints, and greater efforts at reconciliation—rather than less.

What of the argument that a useful, workable, concept is impossible of attainment? This is a more difficult and complex argument. Almost everyone carries around with him either a set of prices that he feels are fair, or equitable, by some standard, or he carries around with him the concept of a means, or a process, that will yield a set of fair prices which probably depends upon the level of sophistication of the person involved. Many people, however, and orthodox economists in particular, are strongly of the opinion that these prices cannot be determined through political action—through government.

Once upon a time it was argued rather generally by orthodox economists that a system of perfectly competitive markets would yield a set of fair prices, in the sense that returns to factors were fair, as well as a set of prices that would maximize the efficiency of the productive system. Economists now are more cautious; they argue that a perfectly competitive economy can be said to generate a set of fair prices, in the sense that returns to factors are fair, only in so far as the ownership of resources, the pattern of inherited wealth, and existing institutions for the economy are somehow specified as being fair and equitable.

So, if pushed hard, the modern economist has a concept of fair prices, albeit a qualified one (i.e., the equilibrium prices in a perfectly competitive economy for some specified pattern of resource ownership, inherited wealth and social institutions). But this modern sophisticate might hasten to say—"the idea of fair and equitable prices bores me, I attach little importance to the concept of fair prices and returns." If he has not made such a statement, it is undoubtedly only because he has not thought of

making it, for his actions make clear his judgment. The modern economist is primarily concerned with efficiency—the efficiency of the firm, the efficiency of the market and the efficiency of the economy.

Here we have reached the nub of the problem. The modern economist does not deny the concept of fair and equitable prices; he has little or no interest in the concept. He is interested in efficiency problems. This is where he works; this is where he does his problem solving. *But in working almost exclusively with efficiency problems modern economists have come to place a high value on efficiency. For many modern economists production efficiency has become the preeminent, if not the monistic, goal for society.*

Now I want to ask this question—what basis does the economist have, when acting as a policy adviser, for rating productive efficiency very high as a social goal, and fair prices and returns for farmers rather low? The answer is—his own personal value system; no more and no less. It is true, of course, that increased productive efficiency is highly correlated with increased real incomes; and Americans like their high and rising material level of living. But it is also true that Americans have other interests—their relative position on the income ladder, the welfare of such institutions as the family, the family farm and small business, and community organization, for example. The point is that in the latter context production efficiency becomes one, and only one, legitimate objective among many and conflicting objectives. In sum, economists have to emancipate themselves from the belief that every action that enhances efficiency is good, and every act that conflicts with it is bad.

The task of economists is to describe and summarize for society the nature and magnitude of resource organizational problems (i.e., product surpluses and deficits) that are likely to emerge from some pattern of parity prices (e.g., 90 per cent of parity, or a flexible formula). Further, the task of economists is to explain to farmers and urban people alike, why, when some set of what-ought-to-be prices are substituted for market prices to achieve an equity objective, that resource allocation problems raise their ugly heads. But it is not the province of the economist to tell farmers and urban people alike that they are wrong in seeking a set of equitable prices, as a means of realizing equitable returns, unless the scheme is internally inconsistent or clearly impossible. Obviously, the persons concerned, farmers in our case, found the price-income consequences of a free market undesirable, or perhaps intolerable, or they would not have left the free market in the first place. The question that society must decide is, then—are the problems raised on the resource allocation side, the efficiency side, by reason of adopting a set of fair or parity prices greater or less than the price-income problems encountered in the free market?

To help answer this question, it further becomes the task of economists and other social scientists to consider ways and means of coping with the resource maladjustments that are likely to result from the adoption of a specific set of fair or parity prices. This task involves idea formulation and analysis at several different levels and in many directions. To illustrate, it would certainly involve: first, the development and consideration of alternative consumption adjustments for dealing with the resource problem—considerations of costs, of benefits and of valuation conflicts; second, the development and consideration of alternative adjustments on the production side—considerations of costs, benefits and valuation conflicts again, and perhaps a similar gamut of considerations for the mechanics of direct price and income support. Analyses such as these would sharpen the issues by presenting the facts concerning and the consequences of alternative courses of action, hence contribute to rational collective decision making.

With respect to agriculture, and price-supporting operations within agriculture, some of the foregoing has been done. Some agricultural leaders have demonstrated considerable ingenuity in the development of consumption adjustment and production adjustment programs as well as the mechanics of price support—the Food Allotment Plan, the Soil Bank Plan and the Brannan Plan come immediately to mind. But until rather recently economists have done a rather poor job describing the quantity consequences—the surplus-deficit consequences—of alternative levels of price supports, and a still poorer job of describing the costs and benefits, as well as valuation conflicts, of various kinds of consumption and production adjustments. The picture has further been confused by the strict admonitions of orthodox economists to return to the sanity of a free market on one hand, and the search for miraculous solutions (e.g. chemurgy and animal agriculture) to farm problems on the other. Hence, the issues have not emerged clear and bold. Society is still groping for a clear statement of the issues, as well as evidence on the issues, consequently decisions with respect to parity prices and price-supporting actions have not been taken with finality.

But I would venture the following guesses with respect to the future. First, that the idea of a set of fair prices, or parity prices, determined by the Congress, which farmers ought to receive, is here to stay. The idea of fair prices and fair incomes for farm people who work hard in a highly uncertain industry, flows deep in the body politic. Second, the above idea will survive and thrive because devices will be developed for coping with chronic overproduction in agriculture, which for all their limitations, society will feel are superior to the violent price-income fluctuations in agriculture that otherwise would result. Third, increases in the efficiency of production through increased capital formation and the introduction

of new technologies within a stable and prosperous agriculture will be so great as to cause almost everyone to forget the efficiencies to be gained where the marginal value product of each factor is equal to its price. In sum, we will experience the same important gains in efficiency in agriculture now experienced in such industries as steel, automobiles and electrical appliances, and we will forget the monopolistic elements involved that we prefer to forget.

IV

For many years the farm marketing system has fascinated Congress. To seek out and eradicate inefficiencies in the farm marketing system as a means of helping farmers, the Congress has allocated millions of dollars to research and service work in marketing over the years. And Republican administrations have traditionally sought a solution to the farm problem in *new markets*. Why this should be I am not quite sure. Perhaps it is because the farm marketing system is a large, sprawling, complex thing that laymen understand rather poorly, hence they cherish the hope that somewhere within this poorly understood thing there exists a miraculous solution: a gigantic inefficiency to be eradicated or a huge new market to be tapped. But many, many marketing studies, some good, some bad, have disclosed no miracles. What they have disclosed is that 50 to 60 per cent of marketing costs are labor costs—labor costs involved in storing, transporting, packaging, processing and serving food and food products. Further, that there are a lot of poor people in the United States who are not starving, but would eat more meat if they had the money to buy it, as well as several hundred million people around the world who are undernourished, but do not have the income to purchase an adequate diet.

When this Administration came to power it set out bravely to find and to develop new markets. It made use of vending machines, farm product queens, and advertising to push food into "new markets"; it sent salesmen abroad to uncover "new markets"; and it converted our agricultural attachés in foreign countries into farm product promoters. But all of this new market activity did not keep surpluses from mounting. Hence, in the past two years the new market work of this Administration has become considerably more realistic. As noted early in the paper, it has turned into a gigantic surplus disposal operation outside the commercial channels of trade. In fiscal 1956, for example, the federal government donated to all recipients at home and abroad food products amounting to $500 million. And since the fall of 1955 the federal government has "traded" $2.2 billion worth of farm products to foreign countries for their currencies under Public Law 480.[4] The new market activities of this

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[4] *The Demand and Price Situation*, USDA, DPS-21, Sept. 1956, page 13.

Administration have not only become more realistic, they have become more sophisticated. The agreement with India whereby $300 million worth of farm commodities will be delivered to that country over a three-year period appears to represent a long step in the direction of integrated action on the part of these two countries. In sum, the new market work of this Administration has come a long way in four years—out of the land of make believe and into the land of hard reality.

But several comments need to be made with respect to the current surplus disposal operations of the USDA. In the first place, those operations are, with the possible exception of the School Lunch Program, what the name implies—emergency operations. Surplus disposal under this Administration has not metamorphosed into a program of sustained demand expansion. Second, these surplus disposal operations are expensive. No one knows exactly how expensive, since we do not know the ultimate worth of foreign currencies obtained under Public Law 480, and products obtained by barter. But we know that the total surplus disposal operation is a big one—now running up to $1.7 billion per year, of which a large share must be considered lost. Third, disposing of surpluses abroad, which now constitute the bulk of the program, is not endearing us to foreign competitors. The important food-exporting nations—Canada, Argentina, New Zealand, Australia, Holland and Denmark—take a dim view of our foreign disposal operations, and may in time take retaliatory actions that will hurt. *Thus, because of their emergency form, program costs and adverse foreign effects, it seems likely that current disposal operations will not be continued in their present size over any long period.* Either the form of the operation must change or the size, or perhaps both.

In this connection one cannot help but speculate as to why this Administration has not given the Food Allotment Plan a more important play. It was first introduced into the Congress by a Republican—Senator Aiken. And the original stamp plan was well received by merchants wherever it was tried. Perhaps a part of the answer is to be found in the fact that large pockets of badly undernourished people in the United States are hard to find these days, and this Administration does not feel that the food allotment idea should be used to up-grade the diet of low-income people. In other words, it has not chosen to use the food allotment device for shifting more animal products into the diets of low-income people, and shifting grain products, potatoes, fats and oils and beans out. Or perhaps a part of the answer is to be found in a more subtle reason. Could it be that this Administration does not want to develop new markets where the government subsidy involved is likely to become permanent? Perhaps it prefers to keep its consumption adjustment operations emergency in nature—in short, surplus disposal.

This raises a rather fundamental question regarding the effectiveness

of consumption adjustment as an instrument of agricultural policy. If a program of consumption adjustment is developed to correct some dietary need of a population—say to increase the animal protein intake of that population—that program may create production problems in agriculture rather than ease them. A consumption program geared *to need* cannot operate effectively tied to a disposal program where the consumption program receives wheat one year, pork products the next and nothing the next. A consumption adjustment program geared *to need* must obtain and distribute the kinds and quantities of food products that dietary needs dictate. Thus, a consumption adjustment program as an instrument of national food policy can and sometimes does come into conflict with the needs of agriculture. We have such an example in the United States right now: the medical profession generally is calling for a reduction in calorie consumption, and the USDA is literally begging people to eat more.

There are times—when undernourishment and food surpluses exist side by side—when food policy and agricultural policy stay hitched reasonably well. But even in these more harmonious situations, I would argue that there are real limits as to what can be done in the way of bringing demands and supplies into balance by adjusting consumption. It seems to me that as a matter of general principle we begin with need plus purchasing power (subsidized or otherwise) and adjust supplies to that demand.

V

In 1933 the federal government made a serious effort to control production. Farmers were paid to do such things as kill little pigs, hold acres idle and plow under crops already planted—and total output was reduced. But with the drought in 1934 controls were relaxed, and since then production control has taken the form of a rather strange game of musical chairs. Every time the music starts (planting season arrives) a chair is pulled out (a control on another crop is imposed) and the players (the resources) circle the remaining commodities looking for a place to light. But when the music stops no resources leave the game. The extra resources just pile into the next commodity, pulling it into price difficulties. But this has been a very strange game indeed. Resources have become more and more productive, by reason of technological advance, as the game has progressed, and total output from the game has increased tremendously.

Then, just as the game was about to collapse in 1940 and 1941, because there were too many productive resources trying to wedge into the few remaining chairs, war came and saved the game. And when the game was about to collapse once again in 1950, war once again saved the day. But,

although war scares abound, fortunately a new war has not materialized in 1955 and 1956 to breathe new life into the game of musical chairs for agriculture.

In this context the idea of renting acres from farmers, and holding those acres out of production—idle—came along (shades of 1933).[5] The idea was given the catchy name of "Soil Bank" and it swept like wild fire across the land—only the orthodox economists held out before it. The plan is simple—remove acres from production, and you remove from production most of the inputs normally employed on those acres. And those acres, it is argued, can be removed by renting them from farmers for roughly the landlord's share. I thought it was a good idea in 1954, and I still think so. The adoption of this course of action by this Administration enables it to come to grips with the problem that has plagued it since it came to office, and every other peacetime administration since World War I—namely, chronic overproduction in the aggregate sense.

Now this is no policy for the faint hearted. As Bottum[6] and others have shown, at least thirty million acres must go out of production before total output will be reduced any noticeable amount. And I have estimated that at least sixty to eighty million acres will need to be removed from production to cut aggregate output four to five per cent—the approximate rate of overproduction at current support levels. We can depend upon farmers to rent their poorer eligible acres to the government, and the ratio between feed and animal products works in reverse in this instance. The rental bill to the U. S. Treasury to remove from production sixty to eighty million acres might run anywhere from $1 billion to $1.5 billion per year, and at this rate year after year.

Further, if proponents and administrators of the soil bank idea get to mixing soil conservation goals and increased productivity for the future in with their immediate plans for reducing production, as a sop to the supposed tender public conscience, the soil bank idea may well end in a fiasco. It is impossible to reduce production and expand it simultaneously. If we are going to reduce aggregate output by four or five per cent we must employ soil conserving practices on every rented acre with the intent of holding the soil in place and only that (e.g., plant timothy grass rather than alfalfa as a cover crop).

Critics of the Soil Bank Program find all kinds of things wrong with it. And I am sure that some new problems will arise once it is in widespread operation. But I will hazard the guess that these operational problems are not the ones that will defeat it. Faint heart and failure to push the

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[5] U.S. News and World Report, for July 27, 1956, carries a news story showing farmers plowing under acres in 1933 and again in 1956.

[6] The "Soil Bank Approach," Farm Policy Forum, Summer, 1956, page 20.

program vigorously as a means of driving farm prices upward,[1] or the converse, high out-of-pocket treasury costs, if it is pushed vigorously, will be its undoing, if such is its fate. A billion to a billion and a half dollars is a lot of money to spend year after year to solve the farm surplus problem, and this may well be the conclusion that this Administration will reach soon, or that society will reach after a few years.

Since high money costs may force other approaches to the problem of adjusting supplies to demand, let us consider briefly the moving-people-out-of-agriculture approach. No serious student of economic and social organization can doubt the continuing need for transferring human re- sources out of agriculture and into urban employment. But no serious student of resource use in agriculture could have failed to observe the long-run, and in fact revolutionary, movement of farm people to the city, and the very rapid rate of out-migration from agriculture in recent years. Since 1940, total employment in agriculture has declined from just slightly under eleven million workers to something under eight million, or by 27 per cent. This is a big decrease—especially when you stop to consider that aggregate output increased by 45 per cent over the same 16 year period.

It leads me to ask the following questions. First, can rural areas in the United States, towns as well as open country, experience a similar de- crease during the next sixteen years without encountering some major problems of social organization? And second, would a similar decrease during the next sixteen years slow down the rate of aggregate output expansion, and bring the rates of output and demand expansion into bal- ance? I am beginning to doubt it. Our ability to substitute capital for labor in agriculture, and still increase output, is unbelievable.

For numerous and obvious reasons, however, I support such policy proposals as "Homesteads in Reverse," an effective, national employ- ment service operating in rural areas, and other mobility programs. But my faith in this approach is shaken. Further, and more important, this "blunderbuss" approach to adjusting supplies to demand is not well adapted to an industry where product price and income elasticities are very low and becoming lower. The line between too much and not enough has become very fine indeed.

The combination of circumstances that make it impossible to reduce government involvement in agriculture, plus the incentive to reduce treasury costs of agriculture programs are pushing—pushing in the direc- tion of a cartelization of agriculture. I am convinced that society is

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[1] This aspect of the program this Administration seems to forget at times—witness the "dazzling" price of 75 per cent of parity recently held out to corn producers. If the goal of higher prices through production control is lost sight of, say to reduce CCC stocks, the will to control production among farmers will erode away.

eventually and inevitably going to grant monopoly powers to agriculture, via government, to permit and to enable the many producers in agriculture to act in concert. And, as in the case of any government enfranchised monopoly, this may be good, or it may be bad, depending upon the circumstances surrounding the monopoly. Hence, I went to set forth the main outlines of a monopolistic course of action for agriculture, which seems to me to have more desirable than undesirable features.[8]

1. It would be the responsibility of Congress to determine and set forth fair, or parity, prices for agriculture, as it does now. But in this scheme of things the role of parity prices has changed. No longer would parity prices serve as pegs on which to support farm market prices; rather they would serve as guides in the setting of national sales quotas. Thus, in the determination of parity prices for agriculture, the Congress would in fact be determining fair prices for both consumers and producers, and the needs and interests of both groups would have to be considered.

2. The USDA would set national sales quotas for each principal agricultural commodity in amounts which the USDA had estimated would clear the market at the predetermined fair, or parity prices. In practice this might mean the establishment of national quotas on each principal farm commodity moving into the marketing channel destined for human consumption (say 15 to 25 commodities, but not on such things as feed grains and feeder pigs and cattle). And these national sales quotas would, of course, vary from year to year as demand conditions changed, or as Congress redefined parity prices.

3. Each *farmer* at the inception of the program would receive a market share, his *pro rata* share, of the national sales quota for each commodity, based probably on his historical record of production. The farmer's market share might be received in small denominational units, to which, for purposes of exposition, we give the name, marketing certificates. And once the program was in operation it would be illegal for a farmer to market any commodity having a national quota except insofar as he had marketing certificates to cover the quantities involved. The number of marketing certificates would not be increased, or decreased, with changes in the national sales quota for a particular commodity. Rather each farmer could market an announced percentage of the face value of each of his certificates —a percentage in accordance with the national sales quota for the

[8] For a similar approach to the problem see the paper by P. H. Stephens, entitled "Writing on the Wall," given before the 29th Annual Convention of the Colorado Wool Growers Association, Steamboat Springs, Colorado, July, 1956.

year. By this device the awkward problem of issuing and confiscating marketing certificates would be avoided for the bulk of agricultural production.

4. Each marketing certificate would be negotiable. Each farmer would be free to buy or sell marketing certificates as he saw fit. By this device freedom of entry and exit would be maintained within a controlled agriculture; by this device the individual farm operator would be free to expand production or to contract it in light of local conditions, as total output was adjusted to demand at a defined fair price. The value of operating in a stabilized agriculture where product prices and returns were relative certain and relative good, and where long-range production plans could be formulated with reasonable assurance of materializing would, of course, get capitalized into these marketing certificates. The price of these certificates would become the cost of doing business in a stabilized agriculture.

Many side "gimmicks" could, of course, be added to the above course of action—storage plans and purchase operations, for example. And many problems may be visualized in connection with the above course of action—the question of USDA estimates going awry, and duplicity in the exchange of production certificates until some experience had been gained with them, for example. But we will leave the details and the operational problems to the politicians and the administrators.

One structural problem within agriculture should, however, be touched upon. The above monopolistic device for agriculture would not reverse, and might well speed up, the trend toward larger farms, chain farm operations and other forms of resource concentration. Thus, if society is serious about maintaining family type farms in American agriculture, other policies with such a goal would need to be linked to this plan, or any other plan for that matter.

Now one final word concerning efficiency in a cartelized agriculture. I would argue that the highly productive agriculture plant that we have in the United States, and the continuing drive toward greater efficiency on the part of individual farmers, have not resulted from freely competitive markets. On the contrary, these benefits have resulted in spite of the uncertainties generated in free markets in agriculture. Production efficiency in American agriculture, I would argue, has grown out of three aspects of American society: (1) the high value placed on technical progress and material well being by society generally, (2) the high level of technical know-how of farm people resulting in turn from a broad base of technical education, both for children and adults, and (3) the broad base of technologies and technicians that have emerged from our institutions of higher learning—the land grant institutions in particular. If this

analysis is correct, a cartelized agriculture of the type outlined above would not impair the efficiency of the agricultural plant. To the contrary, it should enhance the efficiency of the total plant by speeding up the adoption of new technologies and the rate of capital formation in a stabilized agriculture. In sum, and in conclusion, the efficiency problem in a monopolistic economy appear frightening only in a static world of no technological advance; in a highly dynamic world of rapid technological advance and heavy financial commitments, monopolistic forms of economic organization, government sponsored or controlled, may lead to the twin social goals of greater efficiency and fewer inequities.

POLICY IMPLICATIONS OF VERTICAL INTEGRATION IN UNITED STATES AGRICULTURE

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BY WAY of introduction let me explain that I shall attempt to deal with this subject in a rather comprehensive manner. A study of the program of the conference leads me to believe that such an approach is consistent with the objectives of the conference.

Vertical Integration Is Not New

Vertical integration in our food and fiber economy is not new—having existed for centuries prior to the technological revolution. Such integration was characteristic of the era of a self-sufficient agriculture when practically all phases of production, processing, and distribution were performed by the farm unit. Then, the typical farm family produced its own farm supplies, raised its crops and livestock and processed, stored, and distributed its farm commodities. Under such conditions the vertical integration of our food and fiber economy was almost 100 per cent complete. Furthermore, such integration was a function of agriculture itself, since all operations were directed and performed by the farm as a business entity.

Dispersion of Functions in Quest of Efficiency

Along with the increasing tempo of the technological revolution in agriculture has come a gradual dispersion of functions from the farm to business—a trend that is still going on. The dominant force behind this trend has been economic—each operation gravitating towards a state of optimum efficiency, both in terms of location and size of unit.

Early to leave the farm was the spinning and weaving of cloth. Then, with the invention of the steel mouldboard plow, the reaper, etc., the manufacture of farm supplies assumed a significant off-farm status. Gradually, also, the processing of food followed suit as technology in this field increased and as the developing industrial centers provided markets for the output of new food factories. Accompanying this development has been the trend towards larger and larger factories and firms and the expansion of trade territories, until today many firms have achieved national and even international coverage.

In the year 1954, farmers purchased from off-farm sources some $16

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billion of inputs which were not produced on the farms where used.[1] Following harvest, farmers sold some $30 billion of products to processing-distribution firms which, in turn, converted such products into consumer items for which the ultimate buyers paid a sum of $75 billion. When one adds to this total such items as imported foods and fibers, sea foods, and fabrics made from synthetic fibers, the aggregate consumer bill for 1954 is raised to more than $90 billion.

In 1954 the combined operations of our food and fiber economy utilized about 35 per cent of our national working force—one-third of which were employed on the farm and two-thirds off the farm. The total capital investment involved in this undertaking was greater than that of the balance of American industry, combined. These figures illustrate the magnitude to date of the dispersion of functions from the farm as the result of technology. Also, they give some indication of the general dimensions of our food and fiber economy, as it exists today.

This change in the food and fiber part of our economy calls for a clarification of terminology, if we are to be precise. The narrowing of the scope of farm functions has correspondingly restricted the meaning of the term *agriculture*.[2] Yet, because remaining farm functions are closely interrelated to those off the farm, there still is need for a term that encompasses the two. Therefore, to facilitate discussion I hereafter shall use the term *agribusiness* to denote the sum total of both farm and off-farm operations pertaining to food and fiber. Thus defined, the term agribusiness encompasses today roughly the same scope of functions included under the term agriculture before the intrusion of technology.

Vertical Integration for Economic Stability

Simultaneously with the trend toward the dispersion of functions from farm to business has emerged a complex of counter forces pushing towards vertical integration of farm and off-farm functions. (Here I am using the term vertical integration in the comprehensive sense of including any type of formal or informal arrangement that has the effect of more closely relating successive steps in the production and/or processing-distribution of food and fiber.) This development, largely initiated by farmers, has been motivated in large measure by a quest for increased economic stability in terms of "fair" commodity prices at the farm level.[3]

Pressure from producers in the direction of vertical integration of farm and off-farm operations has taken a variety of forms. Early to gain promi-

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[1] Included in this, of course, were such items as feed grains and feeder livestock which originated from other farms.

[2] By agriculture is meant those operations taking place on the farm.

[3] Unless otherwise indicated, the term economic stability will imply stability at a "fair" price to farmers.

nence was the farmer-cooperative development. The farmer cooperative is a device for vertical integration through which a group of growers acquire ownership of off-farm facilities. The early efforts of farmers at cooperative marketing, though effective in certain other respects, produced limited results in terms of raising or stabilizing price levels. In the Marketing Act of 1929 an effort was made to strengthen the stabilizing qualities of cooperatives through the creation of national cooperative marketing agencies, under the supervision of the National Farm Board. However, this venture, also, was disappointing.

A related effort to bring about economic stability through vertical integration has been the marketing agreement and order. Frequently, such agreements and orders are integrated with the operation of cooperatives in that the latter serves as spokesman and bargaining agent for its members in negotiating terms. The basic principle embodied in an agreement-order is the maintenance of price differentiation as between types of market outlets. Commonly the basis for such market segregation is that of charging a higher price for products utilized in a fresh state than for those sold to processors. Usually, also, a quality factor is applied—the better quality going to the higher-paying outlets.

As a technique for vertical integration, a marketing agreement backed by an order is much more far reaching than a cooperative acting alone, in that it imposes uniform minimum producer price standards on all buyers of the given commodity within the area covered. During periods when the commodity involved is in ample supply, such arrangements have the effect of shifting competition among handlers from price to other factors such as efficiency, quality, and market promotion.

Marketing agreements now have been in operation on a few commodities for more than 20 years and currently are in force in almost 70 milk sheds and on about 30 fruit and vegetable crops. The number of agreements in force has almost tripled since World War II. However, to date none have been attempted for any commodity on a national basis.

Two notable facts about the operation of marketing agreements and orders are that they do not entail the use of public funds, other than for general supervision, nor do they involve the ownership of stocks by Commodity Credit Corporation.

In addition to cooperatives and marketing agreements and orders, there has emerged a variety of less formal arrangements, primarily initiated by producers, which have the effect of vertically relating on-farm and off-farm activities pertaining to food and fiber. Most of these have been directed at market expansion. Illustrative of such have been the promotion programs for cotton, dairy products, and wool, and plentiful foods campaigns. In addition to the promotion aspects of these efforts, a signifi-

cant by-product has emerged in the form of the exchange of ideas by representatives of the on-farm and off-farm phases of agribusiness.

Price Support Programs—A Type of Vertical Integration

Supplementary to the evolution of the several types of vertical integration just discussed, has been the development of government price support programs. Inherent in such programs, as they now exist, are certain properties of vertical integration with respect to on-farm and off-farm phases of agribusiness. These programs have the effect of leveling out and reducing the flow of commodities on the free market, particularly at harvest time, by giving farmers the alternative of committing their stocks to the Commodity Credit Corporation at the support level. The net result is that during periods of surplus supplies, such programs tend to increase the price of supported commodities, both for the farmer and to the buyer of his product.

If a government support program is continued year after year for a given commodity, not only does the operation become integrated with on-farm functions, but also with those of off-farm businesses which handle and store the stocks held by Commodity Credit Corporation. Thus, a policy of suddenly liquidating Commodity Credit Corporation wheat stocks would have a far-reaching effect upon grain warehousemen as well as upon farmers.

When one adds together these various efforts to integrate vertically on-farm and off-farm operations in agribusiness, including government support programs, the scope of operation is sizeable—affecting a large portion of the commodities moving to market.

Vertical Integration for Stability by Business

By and large business firms have taken little initiative to integrate their functions with farming operations through the ownership or management of their own farms. The few exceptions to this rule are found mostly in specialized types of production such as canning or freezing crops, certified seeds, and cattle feeding.

However, somewhat in this category and considerably more extensive is the arrangement which canning firms and seed handlers have with growers in which the business firm contracts for the farmer's output prior to planting time. Of course, this type of operation has been in existence for years. A more recent and rapidly expanding type of off-farm-on-farm integration, for which business has taken the initiative, can be illustrated by the extension of feed firms into poultry, livestock, and dairy enterprises. In this type, the business firm participates in such activities as planning, financing, supplying the chicks or feeders, advancing the feed, arranging

for veterinary services, and supervising the marketing of the finished products. This type of operation has grown to large proportions in the case of poultry.

Business firms also have taken initiative for vertically integrating related functions within the business part of agribusiness. To illustrate, certain farm equipment firms have integrated the functions of manufacture, retailing, and user service; certain flour millers operate their own facilities for storage, milling, and promotion; and some food retailers now have interlocked the functions of processing, wholesaling, warehousing, and retailing. Although the motivation for such integration has been a desire for enhancing both the economic stability and the efficiency of the firm, the urge for stability probably has been dominant.

The effect of vertical integration of related functions within the business part of agribusiness depends, of course, upon the policies pursued. If the basic desire is merely to strengthen the economic position of the business firm, particularly in the short run, with little or no consideration as to the status of the producer, the end result may be to subject agriculture to greater instability. To the extent that this is true, the end effect may be that of stimulating even greater pressure from producers for means of integrating related farm and off-farm functions. On the other hand, if business management takes a longer-time point of view and is concerned with the welfare of the producer, the opposite result could be true.

Basis for Farm Pressure for Integration of Farming and Business Functions

As previously indicated, the dominant farm pressure for vertical integration in the food and fiber part of our economy has been directed at interlocking farming and business operations for the purpose of stabilizing farm prices. This pressure, largely initiated by producers, is the product of two types of forces, each composed of a complex of factors. On the one hand, it comes from farmers whose income is low because they have not adequately adjusted to technology. Many farm units, between two and three million, are too small to take full advantage of opportunities offered by technological progress. In addition, the operators of some of these units lack the managerial ability, technical know-how, and capital even to make the best use of their present situation. The fundamental problem facing these farmers is not the price of farm commodities but the need to adapt their lives to the new conditions ushered in by technology. For some, this will mean reorganizing their farming operation on an efficient basis and training themselves to do a better job of management. For others it will mean seeking opportunities off-farm

where they can be more productive and improve their living standards. Although I have deep sympathy for these farmers, the truth is that greater economic stability at the farm level can offer little hope to those who are on undersized units and without means for enlarging them and who, in addition, lack proper know-how and managerial ability. Although the problem of these people, of course, is beyond the scope of this paper, it is appropriate to note that these farmers do contribute to the pressure for stabilized farm prices. Because of their inarticulateness in analyzing their own problem they fail to see that price support programs are of limited value to them.

The other source of impetus for greater price stability in agriculture stems from operators who have efficient units and who are reasonably good managers, but who, from time to time, are caught in a *"cost-price squeeze."* The nature of this malady is well known to agricultural economists. On the cost side, the trend towards wider and wider use of purchased inputs and the expanding requirements for capital have tended to place an increasingly rigid cost structure under farming. On the price side, factors such as the increased ratio of production for sale to that for home consumption, the propensity of agriculture to overproduce, and the relatively inelastic demand for farm products have created a pattern of price behavior that at times becomes incompatible with a rigid cost structure.

Since World War II strong pressure from both sources has existed for government action in the interest of price maintenance and stability.

Policy Implications of Vertical Integration

Let us next consider in the light of previous discussions some of the policy implications of vertical integration in the part of our economy dealing with food and fiber. To point up the discussion I shall state some propositions for your consideration—propositions submitted more in the spirit of hypotheses than proven conclusions:

1. In view of the propensity of American farmers to produce, it is probable that pressures from producers will continue for a decade or longer for some device to enhance economic stability of agriculture at a "fair" price level.

2. Unless we can find means of providing such stability through the private sectors of the economy, then these pressures likely will be directed towards continuing, if not expanded, government price support programs.

3. Solving the instability problem through the efforts of the private sectors of the economy will, in the long run, assure farmers of a more productive, progressive, and prosperous agriculture than will heavy reliance on government price support programs.

4. Such efforts to shift responsibility will, of necessity, entail some type of functional and/or policy vertical integration between farming and related business activities.

5. Any undertaking of this nature will be greatly facilitated if, at the same time, we succeed in accelerating adjustments that mitigate the so-called low-income problem of agriculture.

6. The first basic step towards the achievement of such a goal is the development of a sound, well-thought-through food and fiber policy with an agribusiness rather than agricultural orientation—i.e., a policy that appropriately takes into account both the related on-farm and off-farm aspects of the food and fiber segment of the economy.

7. The development of such a policy entails the application of the principle of vertical integration to the process of policy formulation in that it necessitates the cooperation and team-work of responsible leadership, at all levels of agribusiness, in the art of decision making on a chain basis.

Objective of a Vertically Integrated Policy

If one accepts these propositions, then it logically follows that a high priority should be assigned to the development of a vertically integrated national agribusiness policy. I suggest that the objective of such policy be to harness technology, as related to food and fiber, so as to achieve the maximum benefits for both farm people and the public, generally. To do this, in turn, means emphasis on research to keep new techniques coming along; emphasis on efficiency; and the rapid adjustment to change, all up and down the line. As a rule of thumb, we should seek to increase the efficiency of farm workers per hour at a rate equivalent to the average of American industry.

However, such a policy raises such questions as—what is the impact of such a rate of change on farm families, on the family farm, and on rural communities? The answer is that it will tend to increase the size of farms, raise the capital requirements per unit, require greater skill and managerial ability on the part of the operator and increase the interdependence of farm and related business functions. With respect to the family farm, the weight of evidence seems to be that it will remain dominant—probably as much so as today. However, there will be fewer of them and they will be somewhat larger in terms of both acreage and capital and will require better trained operators.

In terms of human values, technological change means upsetting old patterns and habits and acquiring new ones. For those remaining on the farm it entails adapting to the larger unit, the larger investment and the greater and more precise skills. For some it will mean transferring to off-

farm employment. But this is nothing new in America. A basic principle to be followed is that of permitting each individual to choose for himself what course he wants to follow. Each should be encouraged to seek the type of employment where he can be most productive in terms of utilizing his talents and where he and his family can be the happiest.

It seems to me that these trends are inevitable and that to retard the rate of change is to create maladjustment which, in terms of human values, means unhappiness and even misery for those families who are the victims of such maladjustment. Furthermore, I suggest that in the long run heavy reliance on private initiative will be most conducive to orderly progress and will tend to minimize the degree of human suffering due to maladjustment. By heavy reliance on private initiative, I mean a sincere and unremitting effort to find ways of achieving our objective through private enterprise before resorting to government programs. However, I do not mean that resort to government should never be made, but that it be a residual course to be pursued after other means have been explored thoroughly.

Along with the stating of our economic objectives, we should set forth the philosophy behind them in terms of basic ideology—i.e., the rights and responsibilities of participants, the role of government, the democratic processes to be followed and the ground rules to be used in negotiation.

Developing a Vertically Integrated Agribusiness Policy

Obviously, a vertically integrated agribusiness policy cannot be attained overnight but must evolve step by step as intelligent research, collaboration and negotiation takes place. Such a procedure will be an evolutionary process—starting with the present, with its $8 billion of surplus products in government hands, and building towards our goal. By and large, the blocks with which we build will be a series of commodity policies, each taking into account the peculiarities of that particular commodity and at the same time each being consistent with the over-all objective. From time to time it may involve operation with a pilot plant on a selected commodity to determine the feasibility of a new idea. If the idea works, then, with proper adaptation, it may be applied to certain other commodities having similar properties and surrounded by similar circumstances.

Actually, this basic procedure is nothing new in America. Essentially it is the same technique by which progress has been made in the past. The main new element that I am injecting is that we adapt and apply the process to the development of a more vertically integrated policy with agribusiness orientation—a policy that will lead us in the direction of our national objective.

The Process of Policy Making

The art of policy making is the art of negotiation, between representatives of group interests having a stake in the matter under discussion, for the purpose of making decisions. The task of evolving an agribusiness policy then becomes one of implementing a series or chain of decisions which together constitute an integrated whole, leading towards the achievement of our national objective.

In reality, an agribusiness policy will be the product of two major streams of decisions which ultimately meet and blend. In turn, each stream is the composite of innumerable smaller streams of decisions which must be integrated.

The larger stream of policy is the product of the decisions made by farmers and businessmen as they conduct their daily affairs, and the smaller—the product of legislative decisions and administrative regulations. (To simplify discussion, the former will be referred to as the informal and the latter as the formal method of policy making.)

The Informal Process of Policy Formulation

The informal phase of agribusiness policy at any given time is the net product of all decisions made throughout the length and breadth of the private sectors of agribusiness. Prior to World War I, virtually all food and fiber policy was made by the informal process. However, following World War I, the formal method began to gain ascendency and has continued to do so since. Currently when reference is made to national farm policy, one immediately thinks of farm programs such as price supports, government credit, subsidized exports, and the soil bank. Thus, so great has become the emphasis on the legislative-regulatory method of policy formulation that today we are hardly conscious that the older method still operates.

But this is a distorted picture. The truth is that even today the informal method continues as a far more important means of formulating national food and fiber policy than does the legislative-regulatory method. Generally speaking, it is by this means that better farming practices are devised and put into use; that improved farm supplies are developed; that frozen foods, self-service in stores, prepackaging, precooked foods, and supermarket retailing have become commonplace. By this means the 95 per cent of our total production of food and fiber, which is never handled by Commodity Credit Corporation, is produced, harvested, processed, and moved into consumption. By this method policy is made for drawing food from every corner of our nation and from foreign countries into every city and town in America in quantities adequate to feed the population with a varied diet, at the same time avoiding serious spoilage and loss.

The informal method of policy formulation is a decentralized process, having no head or center of operation. On the contrary, it functions in tens of millions of places simultaneously each day as farmers and businessmen plan and execute their operations. It is an evolutionary method—automatically reflecting changing conditions. Basically, its quality depends upon the adequacy and soundness of the facts available and upon the competence and objectivity of those who make the decisions. The end product of this process is a body of policy that dominates our food and fiber economy.

An important characteristic of the informal policy-making method is the spontaneity with which it operates. Decisions are based on a combination of past experiences and the future outlook. The weighing of the different factors is the responsibility of management, both at the farm and business levels of operation. Each participant has the responsibility of developing his own records, contacts for information and sources of advice and counsel.

Another important attribute of this method is the rapidity with which it adjusts to changing conditions. It has a built-in device for correcting short-run mistakes through the alteration of previous policy. Illustrative of this is the day-by-day adjustment by farmers and businessmen to market changes.

The informal method also has its weaknesses. For one thing it never has developed a clear set of objectives with respect to the food and fiber phase of our economy. Also it never has developed an integrated policy on which there is general agreement and towards which there is general adherence and support. Perhaps even more serious is the fact that, as our economy has become more complex, farmers and businessmen have fragmentized into numerous organized farmer and business groups frequently working at odds with one another. Through the years each such farm and trade organization has developed a set of policies for itself through decisions made by the membership or by representatives to whom authority has been delegated. The difficulty is that each organization tends to formulate policy within the narrow scope of interest of its members and with only limited effort to see the problems of the whole food and fiber economy of which it is a part. Only a very limited effort has been made to integrate vertically the resulting fragmented policies into a national agribusiness policy which, in turn, is related to our national economic goals.

The Formal Process of Policy Formulation

The legislative-regulatory process for formulating food and fiber policy was relatively unimportant before World War I. Prior to then its major use had been directed towards the formulation of policies pertaining to

public land sale and settlement, agricultural research and education, farm to market roads, rural mail and regulatory measures establishing weights and measures, grades, standards, disease quarantines, etc. However, since then its importance has grown to prominence.

Under this more formal procedure, decisions are made by legislative bodies and duly appointed public officials. Although the number of individuals responsible for decisions are relatively few, the procedure through which important decisions are processed is complex and time consuming—encompassing conference bodies, working parties, committees, and informal conferences. The whole process operates more or less in a fish bowl in that the proceedings, at the more important steps, are matters of public records.

Into these proceedings pour not only the advice and counsel of officials but also that of the numerous interested private associations. In this way the policy recommendations emanating from the informal method are brought to bear on the formal method.

The fact is that the strongest pressure for government programs has been a product of the informal phase of policy formulation—coming largely from the farm and commodity organizations. During the twenties and early thirties, virtually all major general farm organizations and commodity groups were active along this line. This general support for a government price support program still continues, on their part, even though they differ as to methodology. Initially, the business-dominated trade organizatons generally opposed government support programs or took a neutral position. Later, this attitude tended to soften with numerous associations getting on record in favor of them in one form or another.

One inherent weakness of the formal method of policy making is the slowness with which decisions are made. This applies both to the initiating of new policy and to its modification.

The role of research

The role of research in developing a vertically integrated food and fiber policy is a vital one. Research is the indispensable tool with which truth is explored and determined. In developing an integrated policy, research must be oriented so as to reveal basic facts in relationship to one another. This means first organizing the research project or group of projects so that essential facts will be forthcoming. In many instances it will entail filling in gaps not covered by studies already furnished. Because policy making is an evolutionary process, research, too, must be an evolutionary undertaking.

Research, also, must be related to negotiation as the latter is carried

on among the various interests participating.[4] In effect, a two-way street must be kept open between researchers and policy makers in order that the latter may ask questions of the former and so that answers may flow back to the questioners.

Policy and progress

In building a food and fiber policy for the future we must be bold in seeking sound answers, even willing to explore entirely new approaches to problems. We must find a way of utilizing the productive capacity of our farms in a manner mutually beneficial to farmers and to the public. I am suggesting that a more vertically integrated national food and fiber policy is vital to the achievement of such an end.

This does not imply that a policy needs to be rigid or fixed. On the contrary, national policy must be reasonably fluid in order to expedite adjustment to technological change. This fluidity should result more or less spontaneously from the fact that policy making is the product of a constant stream of decisions flowing together from the formal and informal decision-making sources. If policies become stagnant, it is because the decision-making processes are not functioning at the necessary tempo or with proper quality. Probably it is because certain basic research has been neglected—research that would have provided policy makers with new ideas and alternatives to be considered. To move back one more step, the research may be lacking because responsible policy makers failed to present strategic questions to researchers in the proper manner and with proper timing.

The Broader Role for Agricultural Economists

If the thesis of this paper is correct, then it follows that the role of agricultural economists is being broadened by technological progress. Agricultural economists must orient themselves to the whole problem of food and fiber—the business phases as well as farm. To apply the new term I have suggested, they must become agribusiness economists.

Of course, this field will not be exclusively theirs as they must work with business economists who also are interested in food and fiber problems. Then, of course, both must orient their activities with our national economic goals.

However, this broadening of the field of agricultural economists and the sharing of it more freely with other types of economists in no sense reduces the volume of work to be done or the opportunity for worthwhile

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[4] For a full discussion of the role of negotiation in policy making see *Power and Morality in a Business Society*, Parts II and III, by Selekman and Selekman, McGraw-Hill, 1956.

service. On the contrary it offers new challenges and opportunities on an ever expanding new frontier. Let us hope that during the years ahead agricultural economists set a new record for themselves in terms of working out sound solutions to the so-called farm problems—farm problems that are expanding into agribusiness problems.

Summary

In this paper I have discussed two general types of vertical integration affecting food and fiber—one involving the interlocking of operational functions through ownership, contract, or use of public authority and the other involving the interlocking of policy decisions for the purpose of developing a balanced national food and fiber policy. I have pointed out that the functional type of integration has been inspired in part by farmers and in part by businessmen and that the strongest thrust, largely farmer initiated, has been for the purpose of enhancing economic stability at the farm level. I have contended that the vertical integration of policy has tended to lag behind the needs of our time, with the result that today we have no well formulated set of objectives or basic policies to guide us. Because of this, America today seems to lack a true sense of where it wants to go or how to get there on the food-fiber front. To help correct this situation, I have stressed the need today for giving high priority to the development of such a policy and offered suggestions as to how this might be done.

While there are many implications of vertical integration in United States agriculture, the strongest, in my opinion, is the need for a more vertically integrated food and fiber policy—one that has agribusiness orientation; places prime responsibility on private enterpreneurs; and is consistent with our over-all national and international objectives.

DISCUSSION: AN APPRAISAL OF RECENT CHANGES IN AGRICULTURAL PROGRAMS IN THE UNITED STATES

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Professor Cochrane has examined a number of current and proposed approaches to the excess supply problem in agriculture, including demand expansion, price adjustment, the soil bank and resource transfers. He concludes that none of these approaches offers an acceptable long-run solution. In his judgment such a solution can only be found in the cartelization of agriculture.

Most economists probably will agree with his appraisal of the potential

for demand expansion. Unquestionably, there are some opportunities to widen the domestic market for farm products. But when allowance is made for the substitution effects in both production and consumption, accomplishments are likely to be small in relation to the size of the problem. Without continued heavy export subsidies over the next several years at least, we probably will have great difficulty holding our present export market.

He argues that further downward adjustments in farm prices cannot be counted on to eliminate the excess supply. However, the evidence cited to show that lower price supports have increased rather than decreased the rate of stock accumulation is partly irrelevant. One reason is that during most of the period referred to price support levels were stable at 90 per cent of parity. In addition, other factors were operating to offset the effects of lower supports on CCC acquisitions.

There is little basis for questioning the proposition that adjustments in farm prices can bring about a temporary consistency between market quantities supplied and demanded. In general free prices do have the capacity to clear the farm product markets. The real issue concerns their capacity to stimulate sufficient resource adjustment to produce an approximation to a moving long-run equilibrium. Available evidence certainly suggests that this capacity is small. The conditions for effective resource adaptation with free-market pricing are not fully realized in practice. In part, factor-supply elasticities are too low to permit a rapid rate of resource adjustment. When the rate of maladjustment creation is high, such as in recent years, agriculture quickly slips into a serious state of disequilibrium.

Cochrane's views on the role of prices is disturbing. In his proposal to solve the problem of excess supply, he assigns to prices the function of distributing income and clearing the market. I am sure he would agree that there is a problem of resource allocation in a growing economy. Yet, I am unable to identify any mechanism he would substitute for prices in guiding and encouraging resource adjustments that would do the job more effectively.

Perhaps a more promising approach is to recognize that the free-pricing system has some important practical limitations, that there are ways of improving it and that appropriate public policies can remove some of the obstacles to its effective operation. Although we grant that this would not usher in utopia—a limitation of Cochrane's approach also—I believe it has some real potential that has gone unexploited.

Cochrane says he is convinced that society inevitably will grant monopoly powers to agriculture to permit the many producers to act in concert. While such a development is conceivable, it is hardly in-

evitable. His own proposal is far from a strict grant of monopoly power to farmers, since producers as a group would not be free to set prices and outputs at levels that would maximize net monopoly revenue. Congress is given the job of setting fair prices for farm products. Presumably, nonfarm interests would have more than a passive voice in this determination.

Suppose Congress were to adopt this proposal and fair prices were set close to long-run equilibrium levels under conditions of perfect adjustment in the economy. What might be some of the economic effects?

In the short run at least some resources would be unemployed or employed less efficiently. Farmers who hire considerable labor and machinery would find that they did not need as much. In an effort to minimize costs, they might reduce their hiring and this would lessen the degree of underemployment. Some producers might spend more time at off-farm work in areas where this is available. But most farmers would have little opportunity to make these adjustments. So a situation would be created in which more resources would be absorbed in agriculture than are needed to produce the aggregate sales quota.

The direction of the short-run income effects are clear. As compared to free-market conditions, total factor returns in agriculture would be larger. The additional income would be distributed among producers in proportion to sales quotas. Since these would be based on historic production, the bulk of the income increase would go to the larger farmers, much like under past programs.

There would be a redistribution of income from nonfarmers to farmers. However, the development of the condition of excess supply would have involved a redistribution from farm to nonfarm people. Nonfarm buyers of farm products would have been getting a short-run gain as a result of the low level of prices. The redistribution induced by the proposed program, assuming fair prices were set at long-run equilibrium levels, would simply offset the initial redistribution of income.

Although the average level of factor returns in agriculture under Cochrane's plan would be higher than under short-run free-market conditions, it would not be as high as in a well adjusted farm economy. If enough labor and capital were transferred out of farming to eliminate the excess supply, total returns to factors engaged in farming would be as high as under his proposal. But fewer resources would be employed on farms so the average return would be higher. If we add to the same total factor return from farming the earnings of the factors transferred to nonfarm employments, we get a level of total earnings for resource owners that would be larger in a well balanced agriculture than under his proposal.

Cochrane might say that yes, this is all true, but enough resources cannot be transferred out of farming to produce a close approximation to economic balance. Although he has indicated his support for policy measures having this end in view, he also tells us that his faith in this approach is shaken. Why? We have never made a serious effort to move in this direction. We do not know what it can accomplish. Our basic economic knowledge in this area is very limited. We know comparatively little about the restrictions on factor mobility as they operate at the farm level. Very little research effort has gone into studying the factor markets in agriculture. What is more, we are not likely to use this approach until we get a higher level of public understanding of the problem. As long as important people believe the critical economic problems of agriculture grow out of such things as the greedy nature of middlemen, we can expect more of the same kind of programs we have had in the past. In this area we in the land grant colleges have a major educational responsibility that we have been reluctant to accept.

There are two situations in which factor earnings in agriculture could be as high under Cochrane's proposal as in a farm economy that is well adjusted. First, if Congress were to set fair prices substantially above long-run equilibrium levels, a large net monopoly revenue could be produced. In principle this could be large enough to make total factor incomes larger than in a balanced agriculture. Second, if the proposal were to induce a transfer to nonfarm employments of those resources not needed to produce the required output, total factor incomes could be as large without having to set prices above long-run equilibrium levels. In this case the allocation of resources would be similar to that in a well-balanced agriculture.

Whether fair prices would be set at monopoly levels or not seems to depend on the pattern of economic interests and the distribution of political power in Congress. As a layman in this area, my guess is that under present conditions Congress likely would not permit farmers to reap much if any monopoly gains, even though there is widespread support for the idea of equal income opportunity for farm people. The trend toward greater urbanization probably will reduce the political influence of agriculture in the future, and make a monopoly gain even less likely.

How might the proposal affect the pressure on resource owners to transfer labor and capital out of farming? Cochrane thinks it might speed up the trend toward larger farms.

Since short-run factor earnings would be higher under his proposal, there would be less pressure on resource owners to search out better alternative employment opportunities. Although the resistance to the transfer of labor and capital out of farming appears to be great, I would

expect fewer resources to shift under this proposal. The difference, how-
ever, might not be large in the short run. Many farmers probably would
find themselves with excess capacity. Since marginal revenue would
exceed the additional real cost of using the underemployed resources,
producers would have an incentive to put them to work again. How-
ever, additional output could be sold only with a larger sales quota. Thus,
there would be a demand for marketing certificates. People who were
planning to start farming would add to this demand.

The supply of certificates would come from operators who wanted
to quit farming or to reduce the size of their operations. Death and
retirement would make a small quantity available each year. The bulk
of the certificates, however, would be held by farmers interested in
acquiring more. Some of the same factors that would make the demand
for certificates large would make the supply small.

Although the proposal would give a push to the fuller utilization of
resources, it also would create a resistance in the form of the price that
would have to be paid for an additional sales quota. I suspect this re-
sistance might be rather strong, resulting in an important drag on the
fuller employment of resources.

The price of a marketing certificate might quickly reflect the capital-
ized value of an additional sales quota. In this case people farming at the
time the proposed program took effect would reap a windfall profit when
certificates were sold. New farmers would find that most of the income
effect induced by the program had been dissipated in the price they
paid for the opportunity to sell their products. Consequently, over a
period of years less and less of the benefits would accrue to farm people.

Cochrane assures us that his proposal would not impair the rate of
technical progress in agriculture. This I seriously question. One of the
important conditions making possible the improvement in production
methods has been the short-run opportunity of the innovator to profit
from the introduction of improved technology. This and the pressures of
interfirm competition explain in large part the wide-spread use of new
technology in farming. Under his proposal an additional restriction
would be imposed on the innovator. Before a producer could market
additional output resulting from improved production methods, he would
have to purchase a large sales quota. The early innovators might still be
able to profit. But as more producers wanted to introduce the improve-
ment, the increase in the demand for certificates would boost the price.
Perhaps rather quickly the price would reflect the capitalized value of
the expected increase in returns. And the additional cost of acquiring
a larger sales quota would operate to restrict the use of new technology.

Even if the proposal did not affect the rate of technical progress, there

would still be a problem of capturing the full gains from improved production methods. Suppose output per unit of input increased (say) 10 per cent without a corresponding rise in demand. This would require some transfer of resources out of agriculture to realize fully the gains from the improved technology. If the improvement took place under Cochrane's proposal, most of the impact might show up in the form of more underemployment of resources. Since the encouragement given to resource transfers via the price mechanism would be reduced, some of the gain from improved technology would be lost.

Cochrane's proposal and the soil bank program both recognize the problem of overproduction. However, there are important differences. Participation would be obligatory under his proposal. It is voluntary under the soil bank. Income effects under the soil bank can be induced by payments to encourage participation and by the rise in prices resulting from a cutback in production. Participation payments would not be involved in Cochrane's plan. In fact this plan has some of the characteristics of a generalized marketing quota program similar to the quota programs used in wheat and cotton. The soil bank rations land input. Cochrane's plan would ration sales and indirectly output. Price and income objectives are less clearly defined in the soil bank program. However, both plans have one important weakness in common. They fail to give much encouragement to the transfer of excess labor and capital to nonfarm employments and thereby improve the earning power of resources owned by farm people.

DISCUSSION: POLICY IMPLICATIONS OF VERTICAL INTEGRATION IN UNITED STATES AGRICULTURE

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My comments on Professor Davis' paper must be read with the understanding that I am completely innocent of any specialized knowledge of agricultural economics. I assume that those who arranged the program felt that it might be useful to have an "outsider's" view. In addition, Professor Davis, as his title indicates, is concerned with "vertical integration," and this is a term frequently encountered in industrial economics, a field with which I am conversant.

1. Before commenting on the policy viewpoint put forward in this paper, I would like to say a word about terminology. In the first place, auditors of the Davis paper should be warned that the term "vertical integration" is used here in a general, all-inclusive sense. While I, for

one, am always willing to permit an author to define his terms in any way he finds useful, I am inclined to suggest in this case that greater clarity of discussion might be facilitated if a "vertical integration" were not required to cover such a very wide range. When used in discussions of the business sector of the economy, vertical integration is usually taken to mean the control of two or more stages in the productive-distributive process by a single firm. It has occasionally been used somewhat more broadly to include those cases where two or more nominally independent firms, operating at two or more stages of the productive process, combine their activities on a more or less permanent basis through some form of association (cf. exclusive dealing or agency contracts, long-term requirements contracts, etc.). The reader will note that Davis goes far beyond even this latter extension when, for example, he considers the federal government's price support program as a form of vertical integration. But it seems to me that he has missed the essence of certain other institutional arrangements encountered in agriculture when he insists on classifying them as examples of vertical integration.

The author points out that a move toward vertical integration may be prompted by two motives. It may be hoped, on the one hand, that greater efficiency (i.e. lower cost) can thereby be achieved; on the other, the objective may be to achieve or increase monopoly power or market control—which Davis calls "economic stability." In the latter case, however, he fails to note that vertical integration is not enough by itself to achieve the purpose. For example, he cites farm cooperatives and agricultural marketing agreements as examples of vertical integration in agriculture, pointing out that a motive for the formation of both has been to gain greater price stability for agricultural products. Although we may agree that each of these devices has elements of vertical integration (using the term in its more general sense), the vertical integration is only incidental to any success they may have in achieving "economic stability." The latter requires what we might call—again using the term in a correspondingly general sense—"horizontal integration." That is, to have any significant effect on price it is necessary that a significant share of the market in at least one stage of the productive-distributive process be under the control of a single agency, i.e. either a single firm, or a group of firms acting in concert through some type of agreement or membership in a single organization. In agriculture vertical integration may be a useful or even a necessary technique to achieve market control, but by itself it can accomplish nothing in the way of such control. Indeed, in industrial markets we have examples of this sort of connection between market power and vertical integration. It is sometimes suggested that

metal refiners and fabricators have been motivated to integrate backwards into ore mining, since control of relatively limited and concentrated ore deposits gave them market power that could be applied at the later stages of production. Note, however, that vertical integration in such cases does not give by itself any degree of "economic stability." Control of output at one stage in the productive cycle is the key element, and vertical integration becomes a device for permitting the market power to be used in other markets.

2. Before leaving this part of the discussion there are two other comments I would like to make very briefly. The first is to note that apparently vertical integration in the narrower sense suggested above (i.e. the common ownership by a single firm of facilities at two or more stages in the productive process) has so far at least played a very minor role in agriculture. There seem to be few circumstances where important reductions in cost are possible by combining in a single firm both the growing of agricultural products and their processing and marketing. There is no evidence of which I am aware indicating that the farm cooperatives can perform those functions they have undertaken to perform with any increase in efficiency over the performance of the same activities by an ordinary private firm.

The second comment is to point out that in a sense the two motives for vertical integration delineated by Davis are inimical to each other. Specifically, to the extent that the "economic stability" motive is realized and a degree of control over price achieved, the pressures to reduce cost are mitigated. Although even a firm with significant monopoly power may engage in either "forward" or "backward" vertical integration if such step seems likely to reduce cost, the incentive to do so is very much less than is the case of the firm in the competitive market where the pressures to reduce cost are much more insistent. In the context of Professor Davis' discussion, he may have suggested somewhat incompatible goals for agriculture. On the one hand, he points out that there are several million submarginal farms in the United States today which he suggests should be taken out of production for the sake of everyone concerned. On the other, he wants to see agriculture achieve "economic stability"—which I can only interpret to mean that prices will not fluctuate freely but will be kept at artificially high levels on the average. To the extent the latter goal is reached, the natural market forces that would force the realization of the former goal will be inhibited, and the submarginal farmers may continue to eke out a living with the aid of artificially inflated prices for their products.

3. In turning to the policy suggestions made by Davis I confess to

some difficulty in commenting since his ideas seem subject to several interpretations. Let me hasten to point out that this is quite probably a result of my own naiveté in this field, and not of any ambiguity on his part. If the interpretation I have placed on his paper is erroneous, then the following remarks are misdirected.

I read Davis to be saying something like the following: We cannot, in the foreseeable future rely on anything approximating a free competitive market in agriculture. Major elements of monopoly control over price, output, etc. are necessary and inevitable. Today this monopoly power is wielded directly by the government principally through the price support program. What we should aim for is a shift of this monopoly power by the government into private "agribusiness" hands. The government, in short, should sanction and actively support, where necessary, the "cartelization" of agribusiness. This should all be done so that somehow (in a manner not specified by Davis) we preserve the right of the individual farmer and business man to make the decisions affecting his own activities.

If the preceding paragraph is a fair translation of the position taken in the Davis paper, or at least the logical implication of his position, then I must register a dissent. If we accept for the moment as accurate his forecast that the pressure of the "farm bloc" will be so strong and insistent that we will have either price supports or some other device achieving substantially the same result, I would argue that direct government administration of the program is preferable to turning it over to private hands. Although I am willing to grant that there might indeed be some improvement in the efficiency of administration if this were done, I think that to do so would not be in the public interest. As long as policy is made by governmental processes, the nonagricultural sectors of the economy including business and consumer interests have at least the opportunity to attempt to influence agricultural policy and to review its administration. But if "agribusiness," supported passively by the government, made and administered agricultural "policy," the other elements of the community would be faced with a massive private monopoly (or cartel of several monopolies). If we must have a manipulated, "supported" market, I for one prefer that the manipulation be carried out in the governmental legislative and executive areas, where they can be exposed to the public view. In addition to this preference for public over private monopoly at least in this context, I would point out that by enlarging the sphere to be covered to include "agribusiness" Davis raises a very real conflict in public policy. For his proposal would require not only that agriculture itself be exempted from the antitrust laws, but also that

a very large and significant sector of industry be exempted in whole or in part. I am among that group of economists who seriously deplore such aberrations on the antitrust laws as "fair trade" legislation. This particular form of governmentally sanctioned price fixing would presumably be the type of thing necessary to effect the Davis proposal, and permission to "cooperate" to fix prices would have to be granted to a very large segment of business.

Although Davis does not make clear precisely what role government should play in effecting a "vertically integrated agribusiness policy" I would suggest that there is reason to expect that a good deal of active government participation would inevitably be required. Specifically, an *effective* private cartelization of agribusiness could only be achieved and maintained through the exercise of considerable coercion. Given the large numbers of farmers and large number of small firms in agricultural supply, processing and distributing industries, there would be many who would see it to their advantage to stay out of any voluntary cartelization. (In this connection, witness the very low percentage participation in the current "soil bank" program.) Without virtually complete control, the cartels would be hard put to it to control output sufficiently to keep price at levels acceptable to farmers. Therefore, if the private "vertical integration" scheme of Davis is to work, the power of government to ensure participation would seem to be required. But the grant of such power to private interests would certainly conflict with another of Davis' goals, namely the free exercise of individual choice and decision making.

Indeed, at several points the author indicates this desire for a system that places reliance on individualism and freedom. Yet in almost the same breath he speaks of the need for a "co-ordinated agribusiness policy for the nation." In the realm of economic activity individualism and freedom are effected by reliance on the mechanism of the free market and in such a system no "policy" has to be developed in an a priori, articulated, sense. If one likes he can argue that the market system is a technique for allowing a "national policy" to evolve and change in the face of changing circumstances. In this sense the market is the "co-ordinating" agency. By implication at least Davis, while extolling the virtues of a free-market system, expresses his lack of confidence in the ability of such a system to "work" in agriculture. Although he does not say so explicitly it is probably correct to infer that his main concern here is that the market system, if free, will not result in what the community considers a "fair" (or "desirable") distribution of income. If this is indeed the concern of Davis and others who are convinced that we can no longer

allow the free market to determine the share of income going to the farmer, is it not relevant to suggest that we focus our attention in policy discussions directly on this problem? Certainly there are feasible techniques for altering income distribution which do not require us to abandon the market mechanism completely, or so to restrict its operation that it fails to play its role as a device for achieving a reasonably efficient allocation of resources. And I suspect we could achieve whatever income distribution the workings of our political processes should dictate as desirable in a simpler and more straight-forward fashion than devising what would inevitably be a massive and cumbersome "vertically integrated agribusiness" structure.

CHANGES IN MARKETING AND MARKETING RESEARCH

Chairman: Karl Fox, Iowa State College

ECONOMETRIC MODELS FOR THE DAIRY INDUSTRY

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IN RECENT years there has been an increased awareness of the interrelatedness of different sectors of the economy and of the need for formalizing this concept of interrelatedness into explicit, quantitative systems of structural relations, usually referred to in the literature as econometric models. The purpose of this paper is to determine the extent to which such economic interrelationships in the dairy industry can be formalized and to specify those structural relations whose coefficients should be estimated by statistical means, such as the limited informa- tion method, which take into account the simultaneity of action among the economic variables. My purpose also is to determine those relations for which the single equation approach gives as adequate if not better results. We also are concerned about the importance of economic as- sumptions made with respect to the way the observed phenomena (data) upon which the analysis is based are assumed to be generated. Our inter- est here is that the choice of assumptions affects the method of statistical analysis used—single or simultaneous equations approaches—and thus the nature of estimates obtained for the coefficients in the econome relations. Therefore, in this connection, the paper is concerned (1) with basic formulations and the nature of economic assumptions underlying them, (2) with further statistical assumptions that have to be made given the formulation, and (3) with comparison of results from analyses using different economic and statistical assumptions. Because these considera- tions are interrelated, they are discussed jointly with respect to the sev- eral dairy models that were fitted.

Basic Economic Formulation

The operation of the economic system for dairying is most complex, involving many independent (but in effect mutually related) decisions by individuals who head the multitude of producing and marketing firms and households. Taking account of his institutional environment, each maker of decisions is guided by certain economic signals or stimuli. The

outcome of the decision is considered satisfactory if profits are increased or maximized in the case of an operator of a firm, or if he has attained the highest level on a preference scale for a given cash outlay when he is head of the household.

Because problems in price analysis of the dairy industry are complex, a basic research model must be constructed to bring about simplification to reduce the problem to manageable terms while at the same time presenting in an orderly fashion the network of the significant "stimuli" and "responses" that have relevance to the economic problem studied. For this reason, as a springboard for the specific econometric models whose coefficients in the relations are estimated from empirical data, a basic economic formulation is given in terms of general types of economic relations that are consistent with considerations from economic theory and knowledge of existing institutions.

The following type of relations may be used to specify in a general way the set of functional economic relationships that exist:

Type I. Supply relations for total milk on farms.

Type II. Demand relation for milk on farms.

Type III. Consumer demand relations for the several dairy products (individually and in combination).

Type IV. Demand for storage.

Type V. Demand for exports.

Type VI. Demand for nonfood uses.

Type VII. Import relation.

Type VIII. Relations among different marketing sectors, including price generating equations.

These relations are listed to shed some light on the economic as well as statistical assumptions that must be made to reduce these generalized formulations into specific structural relations for which estimates of their coefficients can be estimated by statistical means.

It is significant that there are no supply relations for the individual uses of milk. The production (and consumption) of any one product depends on that of other dairy products because, within a relatively short period, all must be produced from a fixed supply of milk. That is, the supply of milk going into any one outlet depends not only on the demand for milk in that outlet but also on the simultaneous interaction of the supplies and demand in each of the other outlets. No determinate aggregate supply function exists for a single dairy product and the quantity of milk going into each outlet becomes known only after equilibrium has been reached in the industry. At equilibrium, the sum of the demands for milk in the several outlets must equal the total supply of milk, less net exports and net increases in stocks.

Although all of us are aware in a general way of the considerations with respect to economics and statistics that are involved in translating the above generalized relations into specific econometric formulations, it may be well to catalogue some of these because they have an important bearing on the choice of the specific model that is adopted. With respect to dairy products, significant considerations are (1) availability and nature of data, (2) difficulty of finding sufficiently long time periods in which the economic structure had not changed or that the change can be measured, (3) the effect of the first two (points) on the statistical methods used with respect to the efficient use of all available information, and (4) what can be said about the way in which the observed phenomena (time series data) were generated. Considerations such as these have resulted in several econometric formulations rather than a single unique formulation, which usually is preferred. However, I believe that inspection of the results of these several models gives a better insight into the power of some of our statistical tools as well as to what is really happening to the ever-changing economic structure of the dairy industry.

The first set of econometric formulations, which were fitted separately for the period between World Wars I and II and the period following World War II, are based on three major economic assumptions: (1) production of milk in any given year is predetermined; (2) supply of milk available for human domestic consumption is highly correlated with production; and (3) retail and farm demand are related in some simple manner. If these assumptions are true, a complete structural model need specify equations for economic relations only of types III and VIII. Since these assumptions are important, they merit some discussion.

The quantity of milk produced within a period of a year or less is affected only slightly by current prices received by farmers because many decisions regarding production adjustments are made more than a year in advance of the production period. When production is altered by changing the rate of feeding, the time needed for adjustment is short compared to that needed to increase the milking herd. Major changes in total production of milk usually result from changing the number of cows milked or, in a longer-run situation, by increasing production per cow by improving breeding, feeding and other basic practices.[1] However, the quantity of milk produced in any year does substantially affect the price received by farmers. Analyses to test the validity of this first assumption are discussed in the latter part of this paper.

The supply of milk and dairy products available for domestic human consumption in any period depends not only on the quantity of milk pro-

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[1] From 1948 to 1956, the increase in production was the sharpest on record even though the number of cows changed very little.

duced but also on the quantity fed to animals, the net change in dairy products in storage, and net foreign trade. For the period between World Wars I and II, yearly changes in these outlets were small in relation to total production of milk. Thus, during this period, changes in the supply of milk available for consumption were highly associated with changes in production. However, this was not true during years of large wartime demand for export and for the years after World War II in which substantial quantities of dairy products were bought by the government for price support.

The third assumption assigns a passive role to the marketing system—that of transmitting information about retail consumer demand to farmers in a simple way. It also implies that demand relationships should be measured at the final consumption level, which for most dairy products is at retail.

Based on these three assumptions, several formulations were used to describe the price and demand structure for dairy products for the period between World Wars I and II and for the period after World War II. The basic difference between the prewar and postwar models is that the latter take into account interrelationships between the dairy economy and the fats and oils economies because of the increasing importance of margarine and "filled" milk products. In addition, allowances for the effects of the increasing importance of American cheese in the family diet (frequently as a substitute for meat, poultry and fish) and its contribution to total use of milk were made by including a separate equation for cheese in the postwar system.

Although several formulations were fitted, only one formulation for the postwar period is shown since it is illustrative of the structural relations involved. These relations are:

Demand Relations

$Q_t,\ P_t\ ;\ D$	(fluid milk and cream)	(1)
$Q_b,\ P_b\ ;\ D,\ P_m$	(butter)	(2)
$Q_c,\ P_c\ ;\ D,\ P_a$	(American cheese)	(3)
$Q_o,\ P_o\ ;\ D$	(other dairy products)	(4)
$Q_m,\ P_b\ ;\ D,\ P_m$	(margarine)	(5)

Price Generating Relations

$P_t\ :\ D,\ P_m,\ Q$	(fluid milk and cream)	(6)
$P_b\ :\ D,\ P_m,\ Q$	(butter)	(7)
$P_c\ :\ D,\ P_m,\ Q$	(American cheese)	(8)
$P_o\ :\ D,\ P_m,\ Q$	(other dairy products)	(9)

In the above formulation, the symbols used are defined as follows: Q_t, milk used for fluid milk and cream; Q_b, milk used for butter; Q_c, milk used for American cheese; Q_o, milk used for other dairy products; Q_m,

quantity of margarine consumed; P_f, retail price of fluid milk and cream; P_b, retail price of butter; P_c, retail price of American cheese; P_o, price of other manufactured dairy products; P_m, retail price of margarine; P_s, retail price of substitutes for cheese (meats, poultry and fish); Q, total quantity of milk available for consumption; and D, disposable consumer income.

Because of the first two assumptions, the total quantity of milk available for consumption is assumed to be predetermined. As is usual for commodity demand analyses, consumer disposable income is taken as exogenous for this model. During the years used in the postwar analysis, only about 20 percent of the supply of fats and oils, other than butter and lard, used in food products was used in margarine. Hence, it can be assumed that factors which affect consumption of margarine had only a minor effect on the prices of fats and oils used in this product.[2] Since the wholesale price of margarine varies in about the same way as do the prices of fats and oils used in it, the price of margarine can be taken in this analysis as a variable that affects the several variables determined simultaneously by the model but which is affected only slightly by them. However, the quantity of margarine consumed is determined in part by developments in the dairy industry. Also during this period, only about 6 percent of the total amount spent by consumers on meats, poultry, fish and cheese was spent for the purchase of American cheese. Thus, factors that affect the consumption of American cheese probably had only a negligible effect on prices of meats, poultry, and fish and, for this reason, these prices can be assumed as given in the analysis.

As discussed previously, the quantities of milk channeled into each outlet are determined simultaneously. Thus, the model consists of the four endogenous quantities and four endogenous prices of individual groups of dairy prices, and the endogenous quantity of margarine consumed—or nine endogenous variables in all. Since we have nine equations corresponding to our nine endogenous variables, this is a complete model. However, the following identity always holds:

$$Q_f + Q_b + Q_c + Q_o = Q \qquad (10)$$

Several variations in the formulation of a model of this type are possible. For example, we may retain the five demand relations but, in place of the four price-generating relations, use a single price-generating relation for all milk, at the farm level, which turns out to be the demand for milk at the farm. We then can relate each of the individual retail prices to the over-all price, or in this case the farm price for all milk, through a market

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[2] For further details regarding the demand and price structure for edible fats and oils and their products, see Sidney J. Armore, *The Demand and Price Structure for Food Fats and Oils*, U. S. Dept. Agr., Tech. Bull. 1068, 1953.

behaviour relation. This gives us 10 relations in all, but our balance is retained as this model has an extra endogenous variable, namely, the farm price of milk. This alternative formulation does not affect the estimates of coefficients in the demand relation, providing the same predetermined variables are used in each formulation. However, estimates of prices differ somewhat because a different sort of market structure is assumed in each instance.

In a forthcoming bulletin, I shall present several formulations for each of several models that relate to dairy products. When interest is centered in price information and price forecasting, the price-generating equations are preferred because prices may be estimated directly while a 2-step analysis is required when market behavior relations are used. In addition, errors of estimate probably are less when a separate price-generating equation is used for each product, since the market structures differ for each product.

Some Empirical Results

Table 1 presents estimates of price and income elasticities obtained from analyses using both the single and simultaneous equations approach. These analyses are based on data in constant 1935-39 dollars for the period 1924-41, expressed either as actual data or as year-to-year differences of actual data. The estimates from the simultaneous equations approach using actual data are based on two separate formulations, each assuming a different marketing structure. In analysis I, a single composite price is used in all the demand relations to estimate demand coefficients, which are then adjusted for the bias arising from differences in the price flexibility among retail prices of dairy products on the basis of a regression relationship prevailing between the individual prices and the single composite price. All other analyses based on the simultaneous equations approach are consistent with the formulation discussed earlier. For those analyses in which the results from only the least squares method are shown, the demand coefficients with respect to price obtained from the simultaneous equations approach were of wrong sign, except evaporated milk. Moreover, none of them were statistically different from zero.

In general, higher coefficients, in terms of absolute value, were obtained from the multi-equation approach. Price elasticities for fluid milk and cream estimated by the single equation method range between -0.2 and -0.3 compared with coefficients of -0.4 and -0.8 for the simultaneous equations method. Estimates of price elasticities for butter obtained from the single equation method range between -0.2 and -0.3, compared to the coefficients of -0.4 to -0.6 in the structural model. Marked differences in the price elasticities for the aggregate of manufactured dairy

TABLE 1. CONSUMPTION OF SPECIFIED DAIRY PRODUCTS: ESTIMATES OF PRICE AND INCOME ELASTICITIES AND PERCENTAGE COEFFICIENTS FOR "TIME," BASED ON SINGLE AND MULTIPLE EQUATION MODELS, BY TYPE OF ANALYSIS, BASED ON DATA FOR 1924–41[1]

Commodity and analysis	Effect of time per year[2]	Demand elasticity with respect to—[3]			
		Own price		Income	
		Value	Standard error	Value	Standard error
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Fluid milk and cream:					
Analysis based on data expressed as—					
Actual data:					
Simultaneous approach:					
Analysis I[4]	−0.32	−0.35[5]	0.24	0.17[6]	0.09
Analysis II[7]	.37[5]	−.77[5]	.64	.27[5]	.18
Least squares method[8]	−.01[5]	−.22[5]	.15	.10[5]	.05
Year-to-year differences, least squares method[8]	.12[5]	−.27[5]	.17	.10[5]	.06
Butter:					
Analysis based on data expressed as—					
Actual data:					
Simultaneous approach:					
Analysis I[4]	−.84	−.47	.20	.19[5]	.16
Analysis II[7]	−1.18	−.39	.15	.15[5]	.14
Least squares method[8]	−.77	−.16[6]	.09	−.06[5]	.09
Year-to-year differences:					
Simultaneous approach, analysis III[7]	−1.63	−.62	.19	.39[6]	.20
Least squares method[8]	−.86	−.25[6]	.13	.06[5]	.15
Manufactured dairy products excluding butter:					
Analysis based on data expressed as—					
Actual data:					
Simultaneous approach:					
Analysis I[4]	1.40	−2.15	.94	1.16	.45
Analysis II[7]	.07[5]	−1.61	.66	1.02	.39
Least squares method[8]	1.75	−.50	.30	.39	.20
Year-to-year differences:					
Simultaneous approach, analysis III[7]	.74	−1.11	.30	.84	.28
Least squares method[8]	1.32	−.74	.29	.61	.23
Least squares analysis based on first differences of logarithms:					
American cheese	2.21	−.25[5]	.27	.32[5]	.22
Evaporated milk	1.16	−1.08	.37	.59	.23
Ice cream	1.77	—	—	1.01	.07

[1] Variables used in these analyses described on page 326.

[2] Coefficient associated with time in the demand equation based on actual data, and constant in the demand equation based on first difference, divided by average quantities consumed during 1924–41.

[3] Computed at mean values of the economic variables.

[4] Based on equations similar to demand relations (1) to (5), page 326, except a single composite price (index of retail prices of all dairy products, BLS) was used in all the equations. The coefficients were adjusted for bias resulting from use of composite price by coefficients in retail price relations relating individual product price with composite price. Standard errors take into account the standard errors in the two regressions.

[5] Coefficient does not differ significantly from zero when tested at the 10 percent level.

[6] Coefficient differs significantly from zero at the 10 percent level but not at the 5 percent level.

[7] Based on coefficients in equations similar to demand relations (1) to (5), page 326.

[8] Based on coefficients obtained from regression analysis using consumption as a function of price, income and time.

products excluding butter also are observed. These comparisons are based on results from least squares regression of prices and income upon consumption. If they were based on regressions of quantity upon price and income, as is commonly done for many agricultural commodities, estimates from the simultaneous equations approach probably would tend to be lower than estimates from least squares. For example, based on year-to-year differences of actual data when the least squares method was used, demand elasticities of −1.16 and 0.88 with respect to price and income, respectively, were obtained when quantity and income were considered as independent variables and of −0.25 and 0.06 with respect to price and income, respectively, when price and income were independent variables. Based on the same data, demand elasticities for butter of −0.62 and 0.39 with respect to price and income, respectively, were obtained using the simultaneous equations approach. These values are about half way between the two sets of values obtained from the least squares method.

Differences also were observed in the income elasticities estimated from the two methods. The estimates for fluid milk were about 0.1 using the single equation procedure, compared to a range of 0.2 and 0.3 obtained from the multi-equation method. Greater differences were obtained from the two methods for butter.

Although the reasoning is beyond the scope of this paper, econometricians have shown that in general when coefficients that should be estimated by the simultaneous equations technique are instead estimated by the method of least squares, the results tend to be biased in a statistical sense. However, the direction of the bias is not necessarily known.

Certain dairy products use such a small part of the total milk supply that changes in the demand for them have practically no effect on other dairy products. Experiments we have made suggest that the simultaneous equations procedure can be used only when each of the sub-aggregates represents a substantial part of the total milk equivalent for all dairy products. For those dairy products which represent only a small part of the total milk supply, better estimates of structural coefficients, such as elasticities, probably can be obtained by a direct application of the method of least squares. This was definitely found to be true for evaporated milk. (See table 1.)

To substantiate the conclusions reached above, some of the assumptions implicit in each method of analysis are stated. Each method assumes that the price for milk as a whole is determined by the supply of total milk, after allowing for changes in income and other factors. The simultaneous equations technique assumes that consumption and prices of each of the dairy products are interrelated and simultaneously determined. This

technique also assumes that the quantity consumed of one dairy product affects consumption of other dairy products because their combined consumption must come from the same supply of milk. Implicit in these statements is that consumption of each dairy product is affected by the supply of total milk. On the other hand, the single equation method assumes that the price of the individual dairy product affects consumption but its consumption does not materially affect the level of dairy prices in general. As dairy prices depend in part on the supply of total milk, the least squares approach assumes no observable relationship between consumption of the individual product and supply of total milk.

Because of the interrelationships among the quantities of milk channeled into different outlets, estimates of income elasticities obtained from the single equation approach would be expected to be biased in a statistical sense. This bias arises from the failure of the single equation approach to take into account the effect of variations in consumption of other dairy products resulting from variations in income on the consumption of the product concerned. When total supply of milk is fixed, an increase in disposable income results in a general rise in prices. However, subsequent changes in consumption will not be the same for all dairy products—those with relatively high income elasticities or relatively low price elasticities will increase while those with relatively low income elasticities (though still positive) or relatively high price elasticity will decrease by a corresponding actual amount.

Thus it is possible to get negative coefficients of income elasticity for dairy products when the single equation technique is employed because the effect of the variations in other outlets is not included in the demand equations. For example, the income coefficient was negative for butter in one analysis using the single equation method. This was true for none of the structural analyses. If the dairy product comprises a substantial part of the total milk supply, the estimate for the income coefficient obtained from the single equation procedure measures relative *differences* in income and price elasticities rather than the income effect as such. On the other hand, if the dairy product comprises a very small portion of the total milk supply, estimates of the income coefficient obtained from the single equation model may be nearly equal to those obtained from the structural model. For example, the estimate for the income coefficient obtained from the single equation model for ice cream was unity and for American cheese was 0.3. When the simultaneous equations procedure was used for the aggregate of total cheese, dry whole milk, malted milk and ice cream, the estimates for demand elasticity with respect to income were around 0.5, although the demand elasticity with respect to price was of wrong sign (analysis not shown).

Table 2 presents results from analyses for the period following World War II, consistent with the economic formulation discussed earlier. The analyses are based on year-to-year differences of actual data in current dollars for the period 1947-54.

The essential differences between analysis I and II is that the consumption variables in analysis I include the quantities obtained from CCC supplies or bought with government funds, while these variables in analysis II are adjusted to take into account possible replacements. For the

TABLE 2. CONSUMPTION OF SPECIFIED DAIRY PRODUCTS AND MARGARINE: ESTIMATES OF PRICE AND INCOME ELASTICITIES AND PERCENTAGE COEFFICIENTS FOR "TIME," BASED ON A SIMULTANEOUS EQUATIONS APPROACH AND DATA FOR 1947-54[1]

Analysis and product	Effect of time per year[2]	Price elasticities[3]				Income elasticities[3]	
		Direct		Cross			
		Value	Standard error	Value	Standard error	Value	Standard error
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Analysis I[4]							
Dairy:							
Fluid milk and cream	− 1.32	−0.32	0.22	—	—	0.27	0.38
Butter	− 3.22	−1.37	.92	0.55[5]	0.29	.36	1.71
American cheese	4.27	−.75	.63	.92[5]	.44	− .99	.63
Other products	−14.73	−1.47	.99	—	—	3.06	2.34
Margarine	15.78	−.25	.23	1.50[5]	.74	−1.81	1.37
Analysis II[6]							
Dairy:							
Fluid milk and cream:							
Farm and nonfarm	−1.63	−.41	.27	—	—	.41	.45
Nonfarm only	−1.03	−.47	.27	—	—	.30	.41
Fluid milk only	− .35	−.45	.36	—	—	.24	.53
Butter	− 3.82	−1.30	1.27	.54	.38	.33	2.26
American cheese	3.47	−.90	1.01	1.01[5]	.63	− .79	.95
Other products	−16.80	−1.64	1.16	—	—	3.53	2.75
Margarine	19.08	−.35	.38	1.90[5]	1.29	−2.55	2.29

[1] Estimates obtained by the limited information method from demand equations similar to demand relation (1) to (5), page 326, based on data expressed as year-to-year differences of actual data in current dollars.
[2] The constant value in the demand equation divided by average quantities consumed during period of analysis.
[3] Computed at the average values of the economic variables during the period of analysis.
[4] Consumption variables include quantities obtained from CCC supplies or bought with Government funds.
[5] Coefficient differs significantly from zero when tested at the 10-percent probability level but not at the 5 percent level.
[6] Consumption variables *exclude* 75 percent for butter and 50 percent for cheese of that part of civilian domestic disappearance which was obtained from CCC supplies or bought with Government funds.

period 1947-54, quantities obtained from CCC supplies or bought with government funds in 1954 reached a high of 2, 7 and 8 percent of the total consumption of fluid milk, butter and cheese, respectively. These quantities were distributed largely through the School Lunch and Special School Milk programs. Since the quantities of fluid milk consumed under the regular School Lunch Program are not affected significantly by the relative surpluses of dairy products and because the Special School Milk Program did not begin until late 1954, the quantities of fluid milk bought with government funds can be considered as another regular component of aggregate demand. Therefore, analysis II makes no adjustment in this quantity. However, quantities of butter and cheese transferred from CCC

to the School Lunch Program under Section 6 or 32 may have replaced some margarine and meat served in the lunches. Since the amounts transferred in any year are affected partly by surpluses of these commodities, the consumption variables for butter and cheese and for total milk that were used in analysis II exclude 75 percent for butter and 50 percent for cheese of that part of civilian domestic consumption which was obtained from CCC supplies or bought with government funds. Analysis II also includes additional demand equations for fluid milk and cream and fluid milk only consumed by nonfarm people.

Although the postwar analyses for 1947-54 are based on a relatively short period, for the most part the demand coefficients appear plausible when considered in connection with the results of the interwar analysis and the trends in milk fat and margarine consumption during the postwar period.

The estimates of income elasticities for fluid milk and cream, which are obtained from the postwar analyses, are slightly higher than those of the prewar analyses, while the price elasticities are somewhat lower than those obtained in the prewar analyses. A drop in the price elasticity would have been expected because of the decline in the demand for fluid cream in recent years, the component of this aggregate which usually has been considered to have the higher price elasticity. However, in analysis II the demand coefficient for nonfarm fluid milk only is not significantly lower than the postwar coefficient for the combined nonfarm fluid milk and cream. Annual consumption of cream dropped to 7.7 pounds per person for the period 1951-55 compared with 10.5 pounds in 1935-39. In contrast, annual consumption of fluid whole milk increased to 303 pounds per person during 1951-55 compared with 264 pounds in 1935-39.

Results obtained for American cheese from the simultaneous equations approach confirm those suggested by the least squares analyses for the prewar period, namely, that within limits American cheese is currently considered a substitute for meat, poultry, and fish in preparing family meals.

The following observations can be made from the postwar demand elasticities obtained for butter and margarine: (1) Consumption of butter is affected more by its price than by the price of margarine.[3] (2) The coefficient that relates consumption of butter to its own price is higher than for the interwar model. This is logical because it indicates the increased substitution effect as between margarine and butter. (3) The analysis shows that consumption of margarine is quite sensitive to changes in butter prices, considerably more so than to changes in its own price.

[3] This viewpoint has been commonly accepted in the past; for example, see Frederick Lundy Thomsen and Richard Jay Foote, *Agricultural Prices*, New York, 1952, pp. 417-18.

The elasticities for butter and margarine may reflect what happened when there was a continuous shift in consumer purchases from butter to margarine. However, based on probable consumption behavior of these two products since 1953, we would surmise that the direct-price elasticity of butter is closer to that in the prewar level, with lower cross-price elasticities for both butter and margarine that are consistent with the lower direct-price elasticity for butter. We also would prefer to think that the income elasticities for American cheese and margarine are positive and very inelastic rather than strongly negative in sign as suggested by the postwar analysis.

The use of consumption variables for butter and cheese in analysis II which corrected for the effects of the quantities obtained from CCC supplies or bought with government funds reduced the demand elasticities for butter, although they still were essentially the same as those obtained from analysis I. The income elasticity for cheese also decreased, but the demand elasticities with respect to its own price and the price of the substitute increased. Since a simultaneous equations technique was used, the estimates of coefficients in the equations for other products also were affected, increasing in each instance.

An interesting aspect in the statistical fitting of the postwar equations was the obtaining of spurious results when we treated all the predetermined variables in the usual way in using the limited information method, that is, by including them in the so-called M_{zz} matrix. For example, when the price index of meats, poultry and fish, which was used to measure prices of substitute products in the demand equation for cheese and which was considered as exogenous to the dairy economy, was included in the analysis in the prescribed way, reasonable coefficients were obtained in all the demand equations except that for butter. When the postwar analysis was rerun in a way such that the variable only influenced the coefficients in the cheese equation, consistent results were obtained. Based on the way in which statistical estimates are obtained in the limited information approach, this might have been anticipated. Apparently, when a variable is used which at best is only a crude approximation to the true variable, better results are obtained when its effect is limited to the particular equation in which it appears. This frequently is the case when time is used as a variable.

Effect of Relaxing Assumption That Supply Is Predetermined

We now turn to a model that relaxes the assumption that production of milk is entirely predetermined. In contrast to the basic formulations given earlier, this model is essentially at the farm level and includes only the farm demand for milk although its formulation could easily be ex-

tended to the retail level by the addition of retail demand and price equations for the several dairy products. Consistent with these considerations and applicable to the period between World Wars I and II, the following model was formulated and fitted:

Supply Relation

$$Q_p, \log P_w; \log F, \log C, \log H, \log I, \log R \quad (11)$$

Demand Relation

$$Q_h/L, \log P_w; \log D/L, \log M, \log T, \log S \quad (12)$$

Ending Stock Equation

$$Q_s, Q_p, Q_h; \quad (13)$$

Identity

$$Q_h = Q_p - Q_s + Q_a \quad (14)$$

In the above relations, the following variables are assumed to be predetermined:

F = Value of concentrate rations, milk and cream areas, year beginning April 1.

C = Number of cows and heifers, 2 years old or over, kept for milk, January 1.

H = Hay supply per animal unit, year beginning May 1.

I = Index of productivity of milk production.

R = Index of prices paid by farmers (1910-14 = 100), year beginning April 1.

D = Disposable personal income, calendar year.

L = Population, October 1.

M = Unit labor costs in marketing, calendar year.

T = Time, 1929 = 1, reflecting changes in consumer tastes and preferences.

S = BLS Consumer price index (1947-49 = 100), year beginning April 1.

Q_a = Residual—summation of production of milk not on farms, plus beginning inventory, plus imports minus exports and milk fed to calves.

The endogenous or jointly determined variables are described as follows:

Q_p = Production of milk on farms, year beginning April 1.

Q_h = Domestic consumption of milk and milk equivalent of dairy products, year beginning April 1.

Q_s = Milk equivalent of ending stocks, March 31.

P_w = Prices received by farmers for all milk at wholesale, year beginning April 1.

Since we have 4 equations and 4 endogenous variables, the model is complete.

The previous models were fitted using data on a calendar year basis mainly because better estimates of consumption of milk and dairy products are available by calendar years and because calendar year data are available for a longer time period. Marketing year data for farm production of milk are available only from 1929. However, from the standpoint

of equating production and consumption, marketing year data are prefer-
able since stocks normally are at a minimum on March 31.

Before discussing the actual fitting of this model and evaluating its
results, a little must be said about assumptions as to how the data used in
this analysis are generated. The value of concentrate rations is assumed
to be affected mainly by conditions in the total feed-livestock economy.
The number of cows in the producing herd is assumed to be predeter-
mined.

The index of productivity is intended to reflect increases in production
of milk due to changes in technology such as better feeding methods,
better roughages, and better quality cows. The index of prices paid by
farmers is used as a separate variable in the supply equation to take into
account effects of changes in the price level of the goods and services
that farmers buy and sell. As in the previous analysis, income is assumed
to be exogenous as are unit labor costs, which are used as an indicator of
the costs of marketing. The consumer price index is used to take into
account effects on demand coefficients of changes in the price level.

Beginning stocks of dairy products, imports, exports, production of
milk not on farms, milk fed to calves are combined into a single variable
as the unexplained component in the identity, which equates production
with utilization.

In this formulation, the magnitude of stocks of dairy products at the
end of the marketing year is assumed to reflect lags to changes in the
production-consumption balance rather than speculative aspects. For
example, when production is running high relative to consumption, ending
stocks tend to be higher than when production is running relatively low.

A second formulation also was fitted which eliminated the ending-stock
equation and which included ending stocks as part of the residual quantity
discussed earlier.

We have used only one supply relation for milk production although
we could have specified a separate relation for milk production per cow
and number of cows, the two components of milk production. Each of
these components depends on a set of factors in different time dimensions,
some of which may be related. Theoretically, if these factors can be
specified in relation to the time dimension, either method should give
identical results. However, in practice, specification is difficult and errors
in the data may result in different answers.

The quantity variables in this formulation are linear while the others
are in logarithms. The former are linear to be consistent with the identity.

Since our concern is primarily that of testing the validity of the as-
sumption that supply of milk available for consumption is essentially

predetermined, we discuss only the results for the demand equation. We still are in the exploratory stage on the supply side.

The demand equation (equation 12) was fitted by the limited information method, in each instance using the same variables in the demand equation but with several variations in the formulation of the other relations. These variations include (1) obtaining estimates for the model as shown, (2) a model that eliminated the ending-stock equation, (3) the same model as in (1) but leaving out hay supply per animal unit from the supply equation and (4) the same model as (2) but leaving out hay supply per animal unit.

The range in the estimates of the demand coefficients obtained from using these variations are shown in Table 3. There is a remarkable stability in the demand coefficients despite the variations in the formulation of the other equations.

TABLE 3. DISAPPEARANCE OF TOTAL MILK: ESTIMATES OF DEMAND ELASTICITIES AND PERCENTAGE COEFFICIENTS FOR "TIME," BASED ON SINGLE AND MULTIPLE EQUATION MODELS, BY TYPE OF ANALYSIS, BASED ON DATA FOR 1929–40[1]

| Item | Method of analysis | | |
| | Limited Information[2] | Least Squares | |
		Quantity dependent	Price dependent
	Percent	*Percent*	*Percent*
Effect on disappearance of total milk of a 1 percent change in—			
Price, all milk at wholesale:			
Net effect	−0.29 to −0.31	−0.27	−0.37
Standard error	.06 to .07	.07	.09
Disposable personal income, per capita:			
Net effect	.34 to .35	.33	.38
Standard error	.10 to .11	.11	.13
Unit labor costs in marketing:			
Net effect	−.44 to −.48	−.40	−.61
Standard error	.18 to .20	.19	.42
BLS consumer price index:			
Net effect	.57 to .65	.49	.95
Standard error	.41 to .47	.46	.58
Estimated change in disappearance of total milk, per year:			
Net effect	.81 to .88	.74	1.12
Standard error	.37 to .42	.40	.50

[1] Data by marketing years beginning April 1. Variables are described on page 335.

[2] Range of estimates obtained from fitting the demand equation (equation 12) by limited information method, in each instance using the same variables in the demand equation but with several variations in the formulation of the other relations. These variations include (1) obtaining estimates for the model as shown, (2) a model which eliminated the ending stock equation, (3) the same model as in (1) but leaving out hay supply per animal unit from the supply equation and (4) the same model as (2) but leaving out hay supply per animal unit.

Table 3 also presents estimates of the demand coefficients obtained from two least squares analyses, each having either price or quantity as the dependent variable. The limited information estimates of the demand coefficients fall between the least squares estimates. They also differ from the least squares estimates by less than one standard error of the regression coefficient of the limited information estimate. The results from this analysis suggest little bias in the demand estimates obtained from the earlier models in which supply of milk available for domestic consumption was assumed to be entirely predetermined.

Conclusions

This paper presents ways in which economic interrelationships in the dairy industry can be expressed as econometric systems. It also specifies those structural relations which should be estimated (1) by the limited information method and (2) by the method of least squares. Moreover, it shows the effect of varying economic assumptions on the formulation and the statistical fitting of the demand relations.

On the basis of these several formulations, one may conclude that when there are several end utilizations, each drawing substantially upon the same supply, the limited information method gives better estimates of structural coefficients and should be used to reflect the interrelationships among these utilizations. On the other hand, there are instances, as for example the last formulation, when apparently the statistical techniques and the nature of data are not refined enough to permit the specification of a model that will ferret out these interrelationships. Under these circumstances, alternative estimates from the least squares method and the limited information method do not differ significantly.

THE CHANGING STRUCTURE OF THE FOOD MARKET[*]

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Major Questions

THE common practice is to classify the food industry into the following stages:
1. Consumers
2. Retailers
3. Wholesalers
4. Processors
5. Producers

From any viewpoint, however, production and marketing of foods are integral parts of a single economic process. Some element of this process has always been in ferment. Large-scale production and nationwide distribution of foods were firmly established decades ago. In general, however, until some thirty years ago, large-scale processors along with some small ones procured supplies and made sales through small firms with no effective procurement, price, product, or promotion policies and with no wholesaling facilities.

The changes

Two broad changes have since occurred. First, drastic shifts in scale and technology at retail have been associated with dramatic changes in all other segments of the food industry. Now, many small-scale processors— along with some large ones— sell increasingly on a direct price-specification basis to large retailers with their own price, brand, and promotion policies, wholesaling production facilities and captive supply agencies. Firms in several segments now attempt to extend the scope of their profit policies through manipulation of product, demand, and price. The instruments of firm policy have not changed, but they can now be used at different levels of the production process.

Second, marketing has come to mean a systematic integration of product planning, procurement, manufacturing, and merchandising. Enterprise organization is shifting accordingly. Technology has changed at all levels. New management devices have emerged. These seem to be the really new developments.

The analytical framework

The two sets of change are motivated essentially by enterprise profit objectives. They are achieved in part by shifting market structure. They

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can, therefore, be described, analyzed, and appraised in terms of shifts in five interrelated categories, which together can specify the profit policy of a firm:

(1) scale and method of production;
(2) scale and method of procurement;
(3) merchandising—including nature and number of products, volume control, variation of product, and demand control;
(4) market structure manipulation; and
(5) internal organization and operations of the various types of enter- prises at the several levels of production.

The Retailers

No major change occurs in any one segment alone. Recent changes in retailing are the most spectacular and the closest to consumers. However, there has not been a unique line of causation from retailing back to farm production free of general-economy influences. Even so, specification of retail changes in terms of the profit determinants set out above provides a frame for description and appraisal of the entire food market structure.

Production Scale and Methods

The food store exemplifies a pattern now general in all retailing. One-stop, automobile shopping has been associated with new scale and type, both of stores and companies and methods of operation.

Sales—size distribution

Stores doing $375,000 sales or more annually comprise about 7 per cent of grocery and combination stores. They do about 60 per cent of total business. Retailers grossing from $75,000 to $375,000 yearly comprise less than 20 per cent of stores and do more than 25 per cent of total volume. The remaining 75 per cent of all stores do less than 15 per cent of all business. This concentration in large outlets has increased about equally in chains and independents and in all regions and types of neighborhoods. Sales volume has been increasing fastest in the larger outlets, although most of the increased total sales is from new stores. Suppliers thus sell more than four fifths of their volume to outlets large enough to establish their own procurement, wholesaling, and merchandising policies and often their own manufacturing facilities.

Nearly 40 per cent of the stores affiliated with a supermarket associa- tion gross more than $2 million annually, about 12 per cent do more than $3 million, and the average is nearly $1.75 million annually. Supermarket sales have increased tenfold since 1940. Almost two thirds of the large

markets gross more than $30,000 weekly per outlet, which is the typical minimum target for a new store. About 45 per cent of new supermarkets are grossing more than $50,000 weekly. About 5,000 small stores close annually. Nearly 90 per cent of sales volume in 1960 will be done by stores large enough to develop an enterprise profit policy. They will not primarily handle products differentiated by others. They will be able to use most available physical efficiencies and to perform processing, packaging, and labeling functions. Larger companies will have either absorbed or eliminated the wholesaling function in some commodities.

Physical operations

Size of retail selling, stocking, parking, and total store areas is increasing in all regions. More than 2,250 new supermarkets are built per year, averaging at least $1 million annual gross. Some 300 old supers are renovated yearly. Sale of self-service meat products, packaged produce, and frozen products is accelerating. The large food store is the key unit in shopping centers, where more than half the new starts are made. New markets are still becoming more elaborate and mechanized. Hours of operation per day have been extended. Customers per store and sale per transaction are both still increasing. Clerk service, credit, and delivery have virtually disappeared. Housewares, drugs, cosmetics, magazines, stationery, toys, and hardware are still being introduced into new departments. There are still regional differences in size of outlet, but the pattern of concentration soon will be general throughout the country.

Items handled

The increase in sales and size per store is paralleled by changes in physical operations. The average number of items per store has gone from about 800 in 1930 to more than 5,000. There should be about 6,000 by 1960, with the increase mainly in convenience food items and nonfood products. This increase is not all in new products. The average number of items in each old-line brand is also up sharply. For every three new items, two old ones disappear in the bitter struggle for stocking, reordering, shelf space, facing, and promotion. Household supplies, drugs, toiletries, and baby foods are the major new items. The number of units sold per week for most products is very low. Increased gross and tonnage, therefore, reflect increased number of items. Problems of out-of-stock, ordering, stocking, space allocation, departmental spacing, and promotion have been serious. New products account for about 20 per cent of all sales and nearly 45 percent of grocery department sales. Many new items are just now catching on.

Tonnage and inventories

Tonnage sold has increased about 25 per cent since 1948 with no increase in inventory tonnage. The average retailer inventory for 40 grocery items is 1.1 month, down from 1.4 in 1948. Nonavailable items average about 5 per cent by number, with about 3 per cent out of stock and some 2 per cent in stock but out of shelf. Changes in pack and package have decreased out-of-shelf rates.

Store organization

Packaging of perishables is general, with half the average sales floor used for them. Expansion of frozen foods has been limited by lack of cabinet space. More than half the new markets operate complete bakery departments. Large stores allocate about 15 per cent of merchandise area to produce, nearly as much to meat products, 5 per cent to dairy foods, and the remainder to grocery and other departments. The potential for precooked foods is yet untapped.

Measures of efficiency

Gains in physical efficiency appear to have been captured about equally by all types of large retailers. As measured by sales per employee, which have been rising for a decade, labor efficiency does not seem to increase indefinitely with sales per store. Sales per customer and per check out apparently increase indefinitely with number of check outs and with sales volume. Sales per square foot increase up to the very large sizes and then decline. There is no simple measure of relative physical efficiency by size groups. However, motorized check outs, expres slane, parcel-pickup stations, and carry-out belts and conveyors are generally found only in large outlets, with different methods of operation in smaller stores.

Layout is changing constantly. Back-room price marking is general. Larger stores do much stocking after closing hours. Sales volume is heavily concentrated in all regions on Fridays and Saturdays. Nearly all major companies and affiliated groups have specialists in physical operating methods for each major department. Personnel selection and training programs are general.

Increasing mechanization

New convenience foods and nonfood items may yield further engineering advantage to larger units. Automation is already under way in warehousing, item selection, ordering, billing, inventory control, display building, and carry out. Experimental units have been built for automatic shelf stocking, price marking, and the complete card-punch store. In sum, available data indicate substantial physical advantage in cost as volume

increases. However, rising expense ratios indicate that enhanced physical efficiency has not fully offset rising factor prices. Declining percentage profit margins have partly offset increases in operating expense ratios. Thus, the modern food store differs from its small-scale parent not merely in size of unit and number of items. In terms of physical operations, it is a completely different creature. The prospect, as well as it can be guessed, is for somewhat larger scale and perhaps for drastically different operating methods. There will be still greater sales per store, more spacious layout, even more luxurious appointments and facilities, more room for new products—especially pre-cooked foods, more parking space, mitigation of the check out and bundling bottleneck, and increased mechanization of stocking and prepricing.

Concentration in retailing

New stores have not been heavily concentrated in the largest companies. There has been an accelerated merger movement, but the percentage of total business done by companies with more than 25 units has not increased. The revolution in size per outlet and operating methods is common to large chains and independents alike.

These are the compelling facts: About 45,000 large stores out of some 350,000 do about 7 per cent of the retail food business. Large retailers are increasing their share of the total business volume. Wholesalers, processors, and producers will probably be unable to reverse this trend. Thus, they must adjust their own methods to the requirements of this new retail trade. The final impact of changes in retailing upon other segments is not clear. Procurement policies impinge directly on producers as well as on processors and distributors. New retail merchandising policies directly affect processor and distributors and ultimately affect producers.

Procurement

Two major changes have occurred in procurement by retailers. First, they have required suppliers of some products to sell on a straight price-specification basis. Second, they have required suppliers to adjust their services to the new types of retailing. Failure to adjust involves loss of a major fraction of business. There appear to be dominant buyers in most markets. The terms accorded dominant buyers seem to be extended immediately to all other large buyers. Some retailers are sensitive of the implications of large-scale buying, just as large processors once feared the implications of large-scale selling. Violent controversy has frequently emerged, but the results implied in small-number theory do not seem to be appearing.

In procurement of perishables on a specification price basis, retailers

specify physical standards, volume, and delivery terms. Then, they re-
ceive price offers from suppliers. Most large retailers require direct de-
livery. Branch houses and old-line wholesalers are thus foreclosed from
this trade. Scope of merchandising policy by processors diminishes and
their margins decline. Large retailers in general do not solicit offers and
do not haggle. In this sense, they do not affect prices and margins. Firm
price lists are increasingly used. Retailers seem to spread purchases sys-
tematically to avoid dependence on suppliers and further to avoid estab-
lishment of consumer attachment to particular brands. Nonprice ties are
infrequent.

Retailers justify integrated production units as means to save selling
costs, maintain quality control, and provide a yardstick on other suppliers.
Some control over procurement price may sometimes be attained. Retailer
labeling of items bought in bulk is common. In many cases, specialized
suppliers have developed and service large retailers almost as if they
were integrated departments of the retailer. There is some cooperative
processing among large retailers.

The change in scale at retail leads to direct procurement of specification
items on a cordwood basis, without selling expense, and often at a mini-
mum margin. In consequence, the status of many old-line firms and
markets has deteriorated.

Physical scale and methods of procurement by retailers have also
changed. Market-supply areas have also shifted. Nationwide suppliers
seem to hold an advantage over local processors primarily in highly dif-
ferentiated products. Transportation methods shift drastically in patterns
not clearly understood even by the trade. The wholesale selling function
is disappearing. Large retailers cannot be serviced by street salesmen. The
wholesaling function in general is being taken over by retailers or is in
some cases being eliminated. Channels to retail often approximate the
straight-line specification channels into government and large institutional
outlets. The declining franchise of many wholesaler or processor brands
precludes effective resistance by many suppliers.

Voluntary and cooperative procurement by independent markets is still
confined largely to groceries but is spreading rapidly to other products.
Affiliated retailers do more than 60 per cent of total independent grocery
business, although less than one third of independent markets are so
affiliated. About 80 per cent of large independents own warehouses, but
some 45 per cent of such companies participate in group wholesaling. The
typical affiliated procurement agent operates for practical purposes
almost exactly as does the centrally owned purchasing unit. In the volun-
tary group, an old-line wholesaler sponsors independent grocers and
provides merchandise, advice, promotional material, management aids,

and usually a group label. The cooperative groups are retailers who jointly own and operate a wholesale unit. These voluntary and cooperative stores are estimated to do slightly more business than the chains. They operate almost exactly like the chains, with preprint order books and what amounts to cash terms. Wholesale margins are very low. Processors must first get on the books of such wholesalers in order to get their products on the retail shelves.

Thus, there are two major types of procurement agencies now: the direct buying chains and the direct buying associated groups. Both types are extending into the perishable fields. Even drop shipments generally pass through the wholesaler. The wholesale function is, therefore, effectively integrated with the retail function.

Merchandising

Retail merchandising policy can be described in terms of (1) the commodity mix, (2) product differentiation, (3) promotion, and (4) price policy. Processors and retailers are integrating all four into a coordinated total profit policy. Both market structure and enterprise organization have changed in consequence.

Product mix

The commodity mix seems to be governed by two broad objectives: (1) to facilitate one-stop, total household shopping and (2) to shift kitchen operations into the food industry through convenience items. Demand for new product lines followed a sequence of fresh-frozen products, including entire meals; more than 600 other prepared items; kitchen and other household appliances along with push-button food and bathroom items; a series of specialized products for different age groups; and now experimental methods of preservation. The optimum size and operation of the retail store will change with techniques and new product mixes.

New items

Increases in volume have been concentrated in really new convenience products with constant or decreasing price. Sales have also increased for nonconvenience products which are new in terms of flavor, color, size, package, or other attribute—often introduced in a combination deal. Consumers seem willing quickly to shift to new products, and mass media can make new products known quickly. Apparently, promotion is most effective for new products introduced at the outset of development of the line. Convenience-items tonnage has increased by about 300 per cent since 1950, largely as a net addition to total volume, of which such items are now more than 40 per cent. Frozen foods, soaps and detergents, drugs,

cosmetics, beauty aids, toiletries, and household supplies have contributed most heavily to the increase. Changes seem to catch hold in the Southwest, but they spread quickly.

Nonfoods

Recent gains are greatest in housewares, dishes, toys, and stationery and moderate in health and beauty aids, cooking utensils, kitchen tools, magazines, and outdoor and picnic supplies. Sales of paper, hardware, and soft-goods items have not been increasing much. Most retailers push the high-profit items. Optimum measures of preselling, minimum turnover or gross margins, inventory control, and clean-up sales are yet unsettled. Rack jobbers will probably be used until retailers acquire know-how. Essentially the same physical procedures are used as for foods. Costs of handling and selling are not precisely known. Nonfoods are probably a plus in volume, with far better margins than on foods.

Brand battle

Retailers push their own labels because they consider that (1) their own names are a better consumer pull than packer names; (2) their shelves, bins, and cases should be used mainly to promote their own products; (3) margins are usually better on their own labels; and (4) they avoid being underpriced by a competitor. Accordingly, they push only packer brands which are difficult to duplicate or with strong consumer pull.

Packers without strong brands are reduced to bulk suppliers of specification items with no real merchandising policy. Nearly every major retailer either processes or acquires products for their own labels. Packers state that if they refuse proffered private-label business, they thereby foreclose volume and sale of their own products. If they accept, they lose merchandising control and have no long-run assurance of volume. Some packers accept private-label business and increase promotion of their own brands. Retailers state that very few brands have a compelling franchise. Retailer brands are common in meat, dairy, delicatessen, bakery, and frozen-food departments. While they carry many packer brands in groceries, they say that no single brand must be carried.

Packers claim that retail display and pricing depreciate brands. Retailers reply that many branded items are really undifferentiated. New products, effectively differentiated, enable processors to build a product image and to control selling themes, advertising, pricing, packaging, display, store position, and point of purchase promotion. Once the product is duplicated, these means of profit policy are gone. Thus, the battle of brands is a major focus of the pattern of change.

Retailers and packers agree that there are well-established consumer

loyalties to stores. However, packer brands which are effectively differentiated and promoted must be carried to maintain store loyalty. Unchanged branded products have gained about 10 per cent in sales over the last decade. New or improved products gained 500 per cent. Real differences among many brands have diminished. The retailer can control impulse buying, but packer promotion of a strong brand often forces him to give effective display. Crude data indicate that no national brands have truly national distribution; their rates of change in position are about the same in all regions; about one fifth of them are exposed to less than half the total food store traffic; the average exposure percentage is declining; and they lose position mainly because they lose differentiation. Major advertised brands still dominate grocery volume, but packer merchandising policy may still be narrowing. Specifications procurement by large retailers has also required drastic adjustments in farm production.

Retail advertising and promotion

Retailers large enough to affect procurement practices and margins and to differentiate product can also use virtually every device for advertising and promotion within their own regions. As retailers control more determinants of profit, such control decreases in other segments. Consumer promotion does not seem generally fruitful for old-line established products. Use seems most profitable with new and actually different products. The entire battery of advertising media and methods is increasingly used by large retailers. In many states, fairly small retailers advertise on a cooperative basis. In-store promotions are general. There is now a bandwagon movement to trading stamp plans and other continuing premium plans. Retailers engage research units also, just as processors do. Advertising and retail promotion are carefully planned and tested but, as elsewhere, no precise appraisal appears possible. Most important, retailers can now compete effectively with any other segment of the food industry in this second major component of merchandising policy. Retail sales methods and organization have changed drastically but less so than the changes imposed upon processors and distributors. Even if processor brands are presold, sales methods must be geared to the new scale of retail buyers and procedures. "Selling" of cordwood products is useless or even damaging. Sales methods are identical with those in the governmental or institutional trade. Processing and distributive margins for such goods have been substantially reduced. Price competition among many large retailers is brutal. But the merchandising program of the large seller of any item at any level is a combination of any and all means by which demand can be manipulated favorably—the product mix, quality, wrap, pack, package, style, brand, advertising, and other promo-

tion. Any successful manipulation is almost immediately duplicated by competitors. Some retailers seem sensitive of statutory limitations on methods of merchandising and procurement.

Retail Margins

Retail margins have drifted downward. Margins have been flexible and have been applied on a commodity-class basis, with relatively simple bookkeeping. Large retailers do not confuse size of margin with size of contribution to net receipts. They have not supported resale price maintenance, unfair practices, or minimum markup laws. Price wars are not frequent. Only rarely will large retailers meet local competition item by item and day by day.

Market Structure

Market structure has shifted, with mergers as a major instrument. In 36 mergers reported for the first nine months of 1955, 6,100 stores were involved. More than 50 important mergers occurred in the whole year. About half of the deals involved companies with less than 25 units. Reasons offered include difficulty in finding locations, offers are high–about 5 per cent of the merged stores were acquired by nonfood companies, and tax laws. Mergers accelerate private-brand development. New capacity, scale, and techniques from mergers have broken old distributive channels, eroded old price protection and methods, stimulated pressure for volume by processors, broadened the product mix in food stores, heightened entry into nonfood items, depreciated old brands, eliminated the old pricing principle of the high margin, and slowly seem to be putting most foodstuffs on the fast-turnover basis common to products lacking firm consumer attachment.

The total United States position of major chains has not greatly improved. Regional chains are growing and many develop comprehensive merchandising programs, as do many single-outlet units. Increases in size per unit and in size of company mean that retailers will not again be subordinate in methods or precision of merchandising. Changes in both processing and production will largely reflect retail changes. Similar operations are appearing in the institutional trade, which in some areas accounts for nearly a third of total food business. Again, older types of distributors must either adjust to the new requirements of retailers or defeat them in the battle of brands. A price-leadership structure, both in procurement and in merchandising, exists in many regions. Independent retailers are closely organized and can now use many policies developed by larger companies. Nearly all retail groups in all regions now have a price policy; elasticity is limited both in buying and in selling. When

services are differentiated, cross-elasticities also diminish. As scale and method of operation change, entry elasticity falls. Market structure can be defined in these terms. As the retail component moves away from the atomistic classification, other components move toward that structure.

Enterprise Organization

Food retailers are no longer untrained general merchants who sell bulk items or branded products with no real differentiation, promotion, or price policies. These are large businesses, with high average income and investment and staffed by carefully selected and trained officers. Company executives carry broad responsibility. The store manager is also a major executive, often with 100 subordinates and occasionally 250. Changes in firm structure, policies, and procedures are general, but few governing principles are discussed in formal academic literature. Yet, changes in scale and methods of production, procurement, and merchandising could not have occurred without correlative management changes, especially · for older firms and often as a matter of survival. Here, one principle emerges—most of the activities of the firm are interrelated. Activities jointly related to the enterprise profit account must be subject to a single authority, with a single results stream and a parallel report structure. Activities not so related must be decentralized.

Marketing broader than selling

Marketing now seems to encompass coordination of product, package and label, promotion, sales methods and organization, practices, and market testing. Enterprise management is emphasizing leadership, coordination, and planning rather than specific technical know-how. The general trend toward market orientation is evidenced by new structuring of companies, status for marketing jobs, titles, policies, procedures, and corporate alignments, and new marketing functions—especially in research. Where the firm is large and can vary its product or promotion, marketing departments extend far beyond selling. Where a competitive market structure exists at transfer points and where bulk products are sold, no market policy can exist and the enterprise should be organized accordingly.

Decentralization

Decision making is being decentralized. Some decisions cannot in fact be made above a particular level. In other cases, there is no scale advantage in central decisions or central staff or service functions. Again, what seems to be the governing rule is slowly emerging: If at any administrative level a decision of one unit constrains the decisions of others, joint

profit maximization requires an authority and folding of results. If the decisions are practically independent, then a coordinating authority may be fatal to profit maximization. This principle seems to affect control and appraisal of products, of line and staff functions of all types, and of both market and administrative territories. Management is beginning to center around product lines rather than market functions. The integration into marketing of all related functions has created a complex of unsolved difficulties and devices for solution.

Old-line wholesale selling facilities and methods are virtually obsolete in some trades. Internal transfer pricing among functional departments is ineffective and correlative profit centers seem to be disappearing except where atomistic competition exists at transfer points. Otherwise, transfer prices neither measure nor induce departmental efficiency and may be hostile to combined profit maximization. Companies, therefore, try to create the required conditions or eliminate functional organization. Thus, rigid departmentalization by functions and the exclusive sales franchise are also disappearing. With differentiated products, actions taken by one functional unit in fact limit actions open to related units. Separate departmental profit targets are only by accident consistent with maximum total profits for all related functions. Both authority and results, therefore, center around commodities.

Many staff and line services are clearly interrelated among all units of larger companies—budgets, large or volatile inventories, long-run investment, governmental and labor relations, law, credit and banking policy, overhead allocation, product and processing standards on differentiated products, brands and labels, some types of promotion, auditing, results analysis, and performance appraisal. Even so, central units are yielding nominal control over decisions actually beyond their capacity or offering no scale advantages or other interrelationship.

Sales organization

Processors and wholesalers are adjusting sales organization and methods to the new requirements of retail and institutional outlets. These outlets procure on a bid basis and by direct channels. Thus, *sales* departments are being integrated into *marketing* departments often including product development and engineering; manufacturing, inventory planning, and control; promotion and advertising; sales administration, planning, and management; and market research. There is not yet agreement on proper organization for marketing many different food products from many areas to many different classes of buyers in many different markets. Preoccupation with sales volume and margins is yielding to concern for total profit. Postwar competitive pressures for new products and for full-

line selling has shifted product and sales planning to top management, including the controller. Effective reorganization reflecting the new marketing concept is not easy. Primary departments owning inventories and making sales must be coordinated with such operating functions as commission selling, purchasing, transportation, insurance, or construction. Both must be integrated with staff units. Decentralization requires formulation of policy delegations and affects a change in profit centers. Related decisions among units at the same administrative level must be coordinated. The two major problems are (1) specification of decision-making units with a parallel stream of results and (2) integration with service units. Analysis of these changes is almost nonexistent.

Other Segments

The fabric of recent change is such that none of the major shifts in any firm or segment could easily occur without the others. Thus, in treating changes at retail, many of the related adjustments in other sectors have been touched. Management adjustments are general. Therefore, only few observations relevant to other functions are offered.

Wholesaling

Wholesale sales have increased sixfold since before the war, labor productivity has risen, and both margins and expense ratios have fallen sharply. Cash-and-carry, self-service wholesaling through affiliated warehouses is now nearly universal. In the business of 20 years ago, warehouses were multistoried, with hand operations, traveling salesmen, credit, wagon and rail delivery, small orders from many wholesalers, wholesaler brands, and high expense ratios for assembly, packing and invoicing. To survive, independent retailers had to buy cheaply and operate at low cost. Some 280 retailer-owned wholesalers serving more than 35,000 stores operate without salesmen, deliver on schedule, and finance themselves through cash sales. Merchandising and store-operation counsel are provided systematically. Profits are mainly returned as dividends. Average expense is often lower than in chain operations. Through some 450 voluntary wholesalers with nearly 90,000 affiliates, the retailer may buy from the sponsor, use a chain name, and receive supervision in store layout, operation, and merchandising.

With increased lines and limited brands in each, both classes of wholesalers have made large independent retailers fully competitive with chains through highly efficient plants. The preprint weekly order form virtually eliminates sales expense, a cash basis, and drop shipment. Self-service procurement by retailers probably depreciates most wholesaler brands. It also accelerates consumer advertising and in-store promotion. Larger

retailers are rapidly turning to direct procurement from their own ware-
houses, although some 45 per cent of the largest companies are affiliated
with wholesalers. Rack wholesaling for nonfood and specialty items may
be taken over after experience is gained by retailers. Affiliated groups
are increasingly oriented to retailer profit. They are moving from their
own labels and long-margin items toward those yielding highest profit
to retailers. In a sense, wholesaling is becoming an integrated department
of retailers rather than a self-contained set of independent, profit-seeking
units.

Processors

Processors selling differentiated products have had to change operations
and policies in order to conform to retail trade requirements. Many
established products and merchandising methods are no longer accepta-
ble to retailers. Many retailers can specify product and require price
offers. Consumer control by processors has generally diminished. Even
so, the battle is not over. Many processors have altered enterprise struc-
ture both to adjust to changes and perhaps to control some of them. They
have developed direct-sales merchandising, especially for bulk or speci-
fication items. High-speed and full-capacity operations are being built.
The crucial importance of effective differentiation and promotion is being
recognized. Product planning, new product development, and engineer-
ing have become major functions closely coordinated with manufacturing,
procurement, and sales. Processors seek so to develop, promote, and price
their own products that retailers will find it profitable to give them space
within a fairly broad price range and reasonably free of variation from
small changes in product, price, or promotion by competitors. Generally,
there are few merchandising advantages from national operation in
handling most cordwood foods.

Some old companies recognize that some scale advantages will permit
price competition that retailers cannot meet by other channels. Actually,
differentiated products can acquire and hold shelf space. Accordingly,
they seek new products and new methods of preservation which cannot
easily be duplicated either by retailers or by specialized processors satis-
fied to sell to retailer specifications. And they are also integrating their
management structure for the purpose of coordinating the entire process
of planning, production, and sale of effectively differentiated items. Pro-
motions of all sorts have been accelerated. Processors of all types still
provide a lively competition which is different but no less active.

Producers

The basic changes in retailing, wholesaling, and processing are reflected
in major changes in product, scale, and method of operation of growers in

livestock, poultry, fruits, and vegetables. Cooperative producers who process wholesale branded commodities have also been affected. The nature of the changes, their causes, interrelationships, effects, and possibilities for control do not seem to be fully explored.

Summary

The sweeping changes general to the American economy have been most marked in the food industries. The changes are closely interrelated with respect to the various functions of a given firm and to the functions of firms in different segments of the production process. One way to classify this flux is suggested by the outline of this report. The main sectors involved are consumers, retailers, wholesalers and other distributors, processors, and producers along with operating and service groups. For each enterprise, the profit account can be specified in terms of production, procurement, and merchandising policy; firm structure; and market structure. Any combination of these two sets of attributes would provide a reasonable basis for study. I would like to know what the changes have been and are—their causes, interrelationships, effects, and susceptibility to control. These questions are not presently answered.

DISCUSSION: ECONOMETRIC MODELS FOR THE DAIRY INDUSTRY

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Issues raised by Rojko's paper seem to me to fall into three categories—statistical, economic, and policy. It goes without saying that these categories are not independent.

At the statistical level Rojko devotes most of his attention to the single equation versus the simultaneous multiple equation approach as a technique for estimating economic relations in the dairy industry. He makes a choice between them primarily on the basis of assumptions about the economic relationships of the dairy industry.

However there are two steps in such a statistical investigation. One is a statement of the relationships in quantifiable form and the other is fitting the equations in such a way as to get estimates of the parameters and to account satisfactorily for residuals. In order to handle these residuals satisfactorily there must be some consideration given to the generation of the disturbance. The classical least-squares single-equation model used here assumes that the disturbance has attached itself to the dependent variable only, making it stochastic. A mathematical model under-

lying the simultaneous equations approach for example assumes that the
disturbances generated by the failure to consider many minor influences
attach themselves to the equations of the model.

When residuals are attributed to errors of measurement of particular
variables, the method of weighted regression is indicated. Of course, this
is very difficult as a practical matter because it requires that the investi-
gator know something about the error variances for every variable. All
this is relevant here because of the known errors of measurement in some
of the dairy data. Fox has stated that "as much as 25 per cent of the
reported year-to-year variation in production of milk may have come from
errors of measurement".[1] I gather there are similar doubts about the
accuracy of measurements of consumption of fluid milk and cream, at
least as compared with manufactured dairy products.

Whether it is generally realized or not, a competent investigator such
as Rojko knows that whoever applies a particular econometric tech-
nique has committed himself to the assumptions of the mathematical
model which underlies the technique. With regard to the generation of
disturbances and their treatment, I would prefer to see the problem
recognized explicitly rather than to have it avoided. I hope that in his
forthcoming bulletin Rojko will publish the residuals so that readers will
have another basis for appraising the technical side of his work.

In the economics category there is one statement made that will un-
doubtedly give economists a start. It says that "there are no supply rela-
tions for the individual uses of milk." An additional statement in the
same vein implies that supply in the dairy industry is an *ex post* relation.

From the standpoint of statistical application it is certainly convenient
to assume that the supply of milk is predetermined and to choose a system
where this is apparently so. But it may be too easy a way out. Econo-
mists conceive of the supply relation as the schedule of quantities which
would be forthcoming at alternative prices of the product. Certainly
this is a meaningful relationship at the plant level and theoretically would
be reflected in one of the cost curves of the plant. In the aggregate it is
clear that the quantities of dairy products forthcoming at alternative
prices are not independent. This calls for a set of equations on the supply
side in the same sense that multiple equations on the demand side are
appropriate.

A consideration of supply focuses attention on the plant level of opera-
tions. Also at the plant level demand for products is equated to supply
with plant price determined accordingly. Of the three levels of operation
in the dairy industry—farm, retail, and plant—my opinion is that the stra-

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[1] Karl A. Fox, *The Analysis of Demand for Farm Products*, U. S. Department of
Agriculture, Technical Bulletin No. 1081, September 1953, p. 53.

tegic relationships are to be found at the plant level. This raises a question about the third assumption which states that retail and farm demand are related in a simple way. The only marketing structure with which I am familiar which relates such demands in a simple way is that of perfect competition, and the dairy industry is noted for its concentration and monopoloid elements.

Cavalier treatment is given also to the economist's concepts of grades by the assumption that all milk is homogeneous. Strictly speaking milk that goes into a fluid outlet has been produced according to a different production function than milk for manufacturing. Grade A milk may be diverted to a manufacturing outlet but presumably Grade B milk is not used for fluid consumption. Simplification and aggregation are an important part of any investigation, but if they are carried out too far there is danger of losing economic significance.

In the area of policy further questions may be raised. Most research in the social sciences is not designed to seek knowledge for knowledge's sake but rather to seek knowledge for the solution of individual human and social problems. With all of the private and public policy problems that exist in the dairy industry, it seems reasonable to expect that an econometric investigation would contribute to an understanding or to the direction of solution for some of these problems.

Such an analysis as this does the job only in part. National aggregates and relationships for butter, cheese, and some other manufactured dairy products are relevant to some of the current policy problems. But fluid milk problems are mostly local or regional in nature. The kind of econometric model most useful for fluid milk problems would likely not be so highly aggregated as the one presented here. Even in manufactured milk products there is a geographic location for marketing and price problems that is lost when national aggregates are used.

Use of annual data obscures or ignores one of the most distinctive structural features of the dairy economy and the problems associated with this structure. These have to do with seasonal fluctuations in supply and the subsequent impact on prices. The structural parameters for "summer" milk may be different from those of "winter" milk for example.

Quite aside from the class of problems for which such a highly aggregated model as this is inappropriate, let us assume a problem that requires knowing the price elasticity of demand for a particular dairy product such as butter. For the period 1924-41 there is not one but five price elasticities. As indicated in the text when price is made the dependent variable in the least squares formulation, there is yet another price elasticity. By way of further information the author states that the estimate of elasticity from the simultaneous equations approach lies about half way between

the estimates derived from least squares where first consumption then price is made the dependent variable. Rojko has gotten us into this predicament and has done little to get us out. He infers that the simultaneous approach is better because he uses it for the postwar data. Again there is not one but two price elasticity coefficients. Both values are outside the range given earlier for all six estimates of the earlier years. Anyone hearing or reading this paper must still be in the dark regarding the author's opinion of which one of these estimates for butter is better and why. Unfortunately, too, not enough of the raw materials of the analysis, the data, their limitations, their errors, the residuals, etc., or not enough of the specification of the mathematical models underlying the alternative techniques, has been presented so that an independent judgment might be made.

Actually Rojko is to be congratulated. He is a competent craftsman working in one of the most difficult and complex commodity fields in agricultural economics. The practical problem confronting him is not the ideal one. Rather he is faced with certain data and series available on the dairy industry, and his job is to wring out of these existing data the best parameters he can. One of the conclusions of this work might well be that more adequate data are required if econometric models are to serve competently in the analysis of problems of the dairy industry.

DISCUSSION: THE CHANGING STRUCTURE OF THE FOOD MARKET

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First let my try to summarize what I believe to be the main points of the paper.

1. There has been an important change in the structure of the food market. The change has centered around the growth of the retail food organizations and the changes in their economic policies.

2. Individual retail organizations are large enough in each market to significantly effect the volume of each product sold in the market. The only way to sell food products in volume is to sell through these large organizations. This gives power to these organizations.

3. Vertical integration has effectively integrated the wholesaling function with retailing. Wholesalers no longer operate as agencies with independent merchandising policies.

4. Processors are forced to act as bulk suppliers. This eliminates some of the benefits they have had from brand differentiation.

5. As the integrated retail organizations become more powerful, the processing industry becomes more decentralized.

Thus, the effective control of merchandising and other profit policies in food marketing has shifted to the retail organizations.

The ideas presented in the paper have been of considerable interest and are stimulating. This is an area of agricultural marketing that needs much work and is receiving almost none.

The paper is almost completely lacking in documentation. The material is drawn largely from Dr. Mehren's personal experience and personal observations.

I thank him for his views and appreciate the difficulty of varifying these kinds of conclusions. I think we need more of the kind of thing he has done. His problem of documentation only goes to point out the great difficulty of doing objective research in this area.

In the limited time I have had, I have attempted to investigate several of his statements and implied conclusions with the following results:

1. Mehren implies that the change in structure has reduced the retail margin. He said, "Retail margins have drifted downward—meats by about one half." USDA costs and margins data contradict this. Indications, at least for beef and pork, are that the retail margin has not declined at all since 1949. An attempt to reconcile such a great difference in "fact" would seem necessary.[1]

2. Another major implication of the paper is that the processors are taking a beating from the retail organizations by being forced to do business as the retailers want it. Although this may be true in terms of freedom of operation, it has not yet shown up in the profit account. The profit statements for 51 food-processing companies reported earnings in 1955 in excess of 10% on investment after taxes—the highest figure since 1950 and considerably higher than the 1935-1939 average of 7.4 percent.[2]

At this point I would like to assume that the major points of the paper represent reliable indications of things to come in the near future and consider further some of the implications and questions that are raised.

If this paper is an accurate description of the market for food, our basic texts in Agricultural Marketing need substantial revision and it is high time we do some serious work in this area.

We need to know a good deal more about the *process of change* in

[1] Agricultural Marketing Service, *Pork Marketing Margins and Costs,* Misc. Pub. No. 711 and *Beef Marketing Margins and Costs,* Misc. Pub. No. 710, Department of Agriculture, Washington, D.C., 1956.

Part of this problem may be that of selecting the time period. However, these data show no "downward drift" in the retail margin for meat from 1949 to 1955.

[2] Agricultural Marketing Service, The Marketing and Transportation Situation, 1957 Outlook Issue. USDA, Washington, D.C., p. 13.

market structure. How are the functions related and interrelated with one another? How do institutions react to change? What are the economics of scale in food processing? How are these economics related to merchandising, finance and product research? What are the scale advantages and limiting factors in retailing for both vertical and horizontal integration? We need to know these things in order to predict the kind of changes in market structure likely to take place and to plan how to improve this structure.

We also need to develop methods for meaningful economic evaluation of market structure. All evidence indicates that our static economic theory is a very inadequate tool for evaluating this changing market structure.

If food-retailing organizations continue to grow and expand their policies of direct buying, what effect will this have on the established marketing facilities—such as terminal produce markets? In helping to develop and improve such markets, are we simply helping to build monuments to a marketing system of a by-gone time?

What kind of producer-marketing organizations are needed to deal with the buyers for these large retail organizations? A large quantity of a given quality of product must be made available. A retailer may also seek to develop a reliable source of supply. Are grower contracts with retail organizations a likely result?

What further effect are new technological developments likely to have on this market structure? What are the possibilities of radiation preservation of complete meals? Might these meals not be purchased and delivered at home, completely eliminating the retail food store? Such meals could be highly differentiated products and could result in a complete reversal of the trend toward retail domination. Many other possible technological changes are in the offing. These should be considered in planning our research into the market structure.

The most important economic question raised, however, deals with pricing policy and with the use of economic power. How much is there to the complaint of Michigan turkey growers that a certain food chain sets the price of turkeys? How much price leadership is there in buying? Marketing agencies do not appear as just passive agents in price determination.

To agricultural economists, the study of this change in market structure is important in determining the effect of the change on the agricultural economy. The merchandising and pricing policies of these powerful retailing organizations may have an important effect on the relative prices and sales of some agricultural products. For example, the frequent practice of allocating a much larger display space to margarine than to butter probably contributes to the surplus problem in dairy products. Similarly, a pricing policy which results in a substantially

higher absolute margin for a high priced commodity compared to a lower priced substitute, even though the cost of merchandising is little or no higher, must influence their relative sales and prices received by producers. The common pricing procedure of offering a few items at low margins or as "loss leaders," with the margins on other items scaled upward to achieve a desired average margin, is another important factor. This is especially true when the competition among the retail firms concentrates on relatively few items as "specials."

What is the effect on producer prices of selling a commodity like turkeys at retail prices below wholesale prices? What is the impact on the dairy business if retailers compete for business by offering milk as a "leader" item?

What kind of economic analysis is appropriate to evaluate a situation where a change in the percent of shelf space allocated to a commodity has more influence on the quantity sold than does a corresponding change in price?

Mehren's paper will have served a very useful purpose if it stimulates the profession to develop the analytical tools and empirical measurements needed to answer such important questions. In fact, a useful project would be one of documenting and verifying the main propositions of the paper itself.

ECONOMIC IMPLICATIONS OF AGRICULTURAL EXPERIMENTS

Chairman: Clifford G. Hildreth,
Michigan State University

ORGANIZATION ACTIVITIES AND CRITERIA IN OBTAINING AND FITTING TECHNICAL PRODUCTION FUNCTIONS[*]

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THREE considerations are important in initiating and carrying out research on physical production functions. A complete review of the details in these three areas would require more time and space than is available. Hence, we restrict our comments to some areas that have been given less space in previous literature. This paper includes comments on two considerations: (1) initiating cooperative research between economists and physical scientists and (2) some special considerations in selecting algebraic forms of functions. The third major consideration, design of experiments, will not be discussed here since it has received comprehensive discussion in recent literature.[1]

Encouraging Cooperation Between Economists and Physical Scientists

Organization of cooperative work between physical scientists and economists is not a problem at Iowa State College. We have completed about a dozen experiments with fertilization of crops, two experiments in feeding hogs with one on drylot and one on pasture, one each in feeding turkeys and broilers and one in feeding dairy cattle.[2] New experi-

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[*] Journal paper J-2548 of the Iowa Agricultural Experiment Station, project 1135.

[1] See, for example, the articles by Anderson, Mason and Hildreth in *Economic Analysis of Fertilizer Use Data* (E. L. Baum, Earl O. Heady, and John Blackmore, Editors), Iowa State College Press, Ames, 1956.

[2] Cf. Earl O. Heady, S. Balloun, and G. W. Dean, *Least-Cost Rations and Optimum Marketing Weights for Turkeys*, Iowa Agr. Exp. Sta. Bul. 443; Earl O. Heady, J. Schnittker, and Norman L. Jacobson, *Milk Production Functions and Economic Optima in Dairy Cow Rations*, Iowa Agr. Exp. Sta. Bul. 444; Earl O. Heady, S. Balloun, and R. W. McAlexander, *Least-Cost Rations and Optimum Marketing Weights for Broilers*, Iowa Agr. Exp. Sta. Bul. 442; Earl O. Heady, J. T. Pesek, and W. G. Brown, *Crop Response Surfaces and Economic Optima in Fertilizer Use*, Iowa Agr. Exp. Sta. Bul. 424; Earl O. Heady, R. Woodworth, D. N. Catron, and G. C. Ashton, *New Procedures in Estimating Feed Substitution Rates and in Determining Economic Optima in Pork Production*, Iowa Agr. Exp. Sta. Bul. 409; W. G. Brown, Earl O. Heady, and J. T. Pesek, *Production Functions, Isoquants and Isoclines in Corn Fertilization*, Iowa Agr. Exp. Sta. Bul. 441.

ments have been started in many of these fields. A wide group of physical scientists at the Iowa State College not only are highly capable in their own fields but also have both an appreciation for, and understanding of, basic economics. Although knowledge of relevant concepts is not restricted to these particular individuals, the spread of economic concepts among physical scientists has come particularly from graduate study. A considerable number of physical scientists have taken the courses in production economics. Their interest has been sufficiently intense that they also have taken the prerequisite courses in economic theory, the basis for enrolling in production economics courses. Each year a number of persons from animal sciences, agronomy and engineering take minors and split majors in production economics. An important part of this trend results from encouragement by major professors in these departments who are capable in their own right and who have a broad scientific interest.

This knowledge of economics obtained in graduate courses is an important catalyst in cooperative work between economists and physical scientists. First hand knowledge of the analytical models allows the agronomist or animal scientist to understand why the coefficients should be derived, and how they can be used. He no longer has to simply guess that the *economists' jargon* can be translated into something that he does not currently understand. He knows the relationships and quantities to be derived and no longer has to *trust* that "someone else can do something with some data which he might collect." The economist would be in a similar position if his aid were solicited in the field of thermodynamics: The outcome would be a mystery in the mind of the economist unless he were instructed in meaning of the engineer's machine and the product that might come from any time or data he put in it.

The first requirement for successful cooperative research is an understanding by the physical scientist of the analytical models from economics. The physical scientist will be more enthused over use of these models as a basis for his experiments if he actually understands them. Although graduate study is a help, it is not necessary that the scientist take graduate courses in economic analysis. The relevant number of concepts is small and can be acquired in a few informal seminars. In my experience, informal sessions with two to four people meeting four to six times have been more productive than formal seminars with a room full of people. Often much time is spent in formal seminars informing those on the "fringe of interest" who will not be engaged in the research. Insufficient time is devoted to the interests of the physical scientist who will actually initiate an experiment. A seminar to inform a group of department heads on the concepts some of their staff will employ generally is not necessary. The most productive research is done by employing capable people

and allowing them to pursue research with the means that appear most productive to them.

Second, the persons involved need to be genuinely interested in the investigation. I doubt that successful cooperative research comes about by administrative edict wherein department heads or directors get together and inform members of their staff that a joint project is to be put into effect. All of my own joint projects have been informal. Joint written projects have not been used. I have carried my share of the research under one of my own departmental projects and persons from the other fields have done the same. The projects have been conducted with mutual interest and trust. This informal arrangement has been possible because all parties have had a genuine interest in their work. I have found it highly successful to contact persons in other departments who promise to have an interest in the economic approach. I spend several informal sessions with them going over the concepts and possible designs. Then, if all see sufficient mutual interest in the approach we get in contact with the proper administrative officials.

A statement by administrators of the need for the research may facilitate cooperative effort, but will not assure highly productive cooperative research. The real stimulus for scientific integration must come from the individual research workers. They must see the need for the prospective product; they must be willing to spend many hours in informal seminars, prior to the actual initiation of the empirical work, in learning and understanding each other's concepts, models and laws. The economist has as much to learn about the biological phenomena and the experimental difficulties as the physical scientist has to learn about the economic concepts. Frequently, the agronomist or animal scientist already has a grasp of the basic relationships involved, but has not formalized them into the theoretical skeleton used by the economist.

Third, the people involved must not be of the "lone-wolf" type. Cooperative research requires that some people "run in packs." We do, of course, need lone-wolf research. Most important fundamental discoveries come from the minds and imagination of individuals. You cannot put two individuals together and have them give birth to a joint idea. Concepts are usually formed in each individual mind. Most discoveries in fundamental science will continue to be born in the minds of individuals. In the case of applied research relating to eventual farm recommendation, the manager generally makes his choice of practices or resource use patterns from more than one field of science. Problems or managerial decisions of any magnitude always involve phenomena from two or more fields. Applied research needs to be planned accordingly.

A fourth requirement is absence of professional jealousy. To take part in cooperative research, means to some people, that others are going to

"trespass upon their field." This sometimes has been true in the past. Certainly this situation does not exist at my own institution among the people with whom I work. Not only does our experiment station administration encourage cooperative ventures, but many persons in the various fields feel that much research work should be planned and conducted jointly. Agronomists even suggest projects in economics. Many of our animal scientists are interested in economics. Furthermore, they have studied enough economics to know the fundamental principles of the field. They are willing and anxious that persons such as myself specify livestock rations that are economically optimum. The agronomists do not feel that the word "fertilizer" comes only from the lips of a soil specialist. They recognize that recommendations for farmers must be in terms of economics if they are to have real basis. Conversely, we are pleased with the interest of agronomists and animal scientists in economics. We know that sound recommendations on economics of fertilization or crop rotations cannot be made without the aid of the agronomists. Our agronomists have become interested in economics and some are as well versed in the relevant economic models as our own staff. They know and use such terms as production functions, isoquants, isoclines and marginal quantities. Our cooperative research has gone far beyond the usual experiments on production functions and includes such things as linear programming of farm adjustments. We would certainly be lost without the active cooperation of the agronomists in providing technical coefficients for these studies.

A fifth requirement is scientific objectivity. One scientist must not have *a special interest in one kind of finding*. Results, whether negative or positive to the *cause* of one scientist, must be accepted and published objectively by both. If each wants to prove his predetermined notions, he will not be willing to accept outcomes in terms of probabilities. Cooperative work cannot flourish successfully unless objectivity exists.

A sixth requirement is to establish a satisfactory division of labor. Generally, in my projects, the arrangement has been for the physical scientist to conduct the actual experiment while I handle the analysis of data. In some cases the largest input of time and experimental funds is in conducting the experiment. In other cases, the analysis of the data is more time consuming. Where the largest burden is in conducting the experiment, I have frequently loaned a graduate student to do part of the work. I have always offered to provide funds or personnel for use by the project leader from the other department. However, this aid is not often needed, although it stands ready should the need develop. In one instance I went to the experiment station director with a person from another department to request funds for him. Generally, however, the division of labor between conducting the experiment and processing of

the data, with joint effort on interpretation and presentation of results, has seemed satisfactory. The initial discussion sessions eventually include a statistician who attempts to suggest an experimental design consistent with the analytical model and the biological phenomena concerned.

A final requirement for successful cooperative research is that the objectives of the two research workers be sufficiently complementary to allow for an integrated approach. Otherwise a basis does not exist for a cooperative project. Interests, however, do not need to be identical. An animal scientist might have prior interest in digestibility of feed materials fed in different proportions, while the economist has prior interest in estimating marginal productivities of feeds. In a case such as this, interests may be sufficiently complementary that the same design and experimental layout can accomplish both ends. In other cases, objectives of research may be partly complementary and partly competitive and the research workers will need to determine which of the competitive phases will be given priority. I believe that priority should first be given to the physical scientist's objectives, since he is the one who eventually must provide the physical layout for the experiment. If a range of complementary objectives is established, sufficient data may be provided for economic analysis, with the chance that this will stimulate further cooperative research for objectives to become entirely complementary.

Selection of Functions

Since recent attention has been given problems of designs for physical experiments, and since the topic is broad in scope, we shall now discuss appropriate forms of functions. We restrict these remarks to choice of functions consistent with the objectives of the research workers and with the biological phenomena concerned. Numerous functions can be fitted to data resulting in widely contrasting recommendations.[3] Given objective statistical tests, however, and the existence of some biological and economic logic, selection of appropriate functions, although difficult, need not be purely a *shot in the dark* as sometimes suggested. We illustrate these points with a few of the many algebraic forms of functions. Characteristics of certain single-variable equations, in relation to economic interpretations, have been discussed elsewhere.[4] Ordinarily these functions have been discussed in terms of ability to reflect positive and

[3] See Paul Johnson, "Alternative Functions for Analyzing Fertilizer-Yield Relationships," *Journal of Farm Economics*, Vol. 35, November 1953, pp. 519-29.

[4] Cf. W. J. Spellman, *Use of the Exponential Yield Curve in Fertilizer Experiments*, U.S.D.A. Tech. Bul. 348; Earl O. Heady, "Use and Estimation of Input-Output Relationships or Productivity Coefficients," *Journal of Farm Economics*, Vol. 34, December 1952, pp. 775-86. D. D. Mason, Chapter 5 in Baum, *et al.*, *op. cit.*

negative marginal products along a single-variable input-output curve, or to provide predictions with comparable standard errors of estimate. Sometimes several types of functions may be almost equally efficient from the standpoint of these criteria. Other properties of biological phenomena often specify the appropriateness of one function over another, even though the functions appear equal in terms of the criteria mentioned for a single-variable input-output curve. We illustrate this point by use of the isocline for fitting production surfaces. We discuss these relevant biological characteristics in relation to a few equations used in predicting surfaces.

Logical and practical considerations

A function associated with economists, as much as any other function, is the power function in equation (1). Frequently because of economy in degrees

$$(1) \qquad Y = aX^b Z^c$$

of freedom, this function gives regression coefficients that are significant at conventional probability levels while other equations do not. This function merely conforms to biologic phenomena, however, wherein the surface has no distinct ridgelines or peaks. The function forms an ever-widening ridge over the input plane. It tends to overestimate values of the dependent variable for large magnitudes of the independent variables and also does not allow negative marginal products (unless coefficients are negative, in which case positive marginal products are not possible). In this sense, the function is not appropriate in estimating, say, a surface for fertilizer response which includes observations carrying to the peak of per acre yields. To allow estimates of this kind, the family of isoclines must converge, over the one-factor combination in the input plane at the point of maximum yield. As is illustrated in equation (2), however, this function gives

$$(2) \qquad X = \left(\frac{Y}{aZ^c} \right)^{1/b}$$

asymptotic isoquants that approach the resource axes and do not allow a wedge to define the positively sloped portion of the surface. This fact is further illustrated in the isoclines. Given the isoquant equation in (2), we can derive the marginal rate of substitution and set it to equal any relevant constant as in (3). From this we can derive

$$(3) \qquad \frac{\partial X}{\partial Z} = - \frac{cX}{bZ} = - k$$

$$(4) \qquad X = \frac{kb}{c} Z$$

the isocline equation in (4) and X becomes a linear function of Z, with the slope of the isocline being kb/c. Since the isoclines pass through the origin and are linear, they fan out over the factor plane and are not appropriate for a surface, such as may be encountered in fertilization, which has a definite peak.

Meat production is unlike other types of production wherein a single level and combination of factors is used in the expectation of obtaining a single output. Instead, every level of factor combination traced out by the isocline has to be employed in livestock production, as the animal is taken from the initial to the final weight. To follow rigidly an isocline of this type would require that the farmer change the ration each day, or even more frequently. Practically, however, farmers change the ration only two or three times during the production process. They wish to feed one ration over a selected time period that *averages least cost* for all gain attained over the period, although this ration does not provide the least-cost formula for each individual unit of gain during this period. If the observations are divided into intervals over the gain surface, a power function can be fitted to each interval to provide isoclines allowing selection of the ration that averages least-cost in each interval. The result is a *spliced isocline* composed of linear segments of different slopes. Practical requirements are met since one ration is specified to be fed over an entire interval. Different rations are allowed for different intervals.

Alternatives exist for retaining the economy of the power function while the characteristics of linear isoclines that pass through the origin are eliminated. We might, for example, add a constant to each of our resource categories as in (5). The marginal rate of substitution, defined as in (6), can be equated to the relevant constant,

$$(5) \qquad Y = a(m + X)^b(n + Z)^c$$

$$(6) \qquad \frac{\partial(m + X)}{\partial(n + Z)} = -\frac{c(m + X)}{b(n + Z)} = -k$$

with the isocline equation derived as in (7). In this isocline equation, X is a linear

$$(7) \qquad X = \left(\frac{kbn}{c} - m \right) + \left(\frac{kb}{c} \right) Z$$

function of Z, with the slope of the isocline being kb/c. However, the isocline does not pass through the origin, but through the X axis if $\frac{kbn}{c} - m$ is positive and through the Z axis if it is negative. The same

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ration or resource combination is no longer optimum for each level of output. Given a constant price ratio, the ration changes with each level of output. Modifications such as this conform with biological phenomena.

Alternative functions

The alterations made above in the power function do not cause its family of isoclines to converge to a single point, such as might be desired in a fertilizer experiment where inputs are large and a maximum per acre yield is defined by one limitational factor combination. An equation to allow linear isoclines converging at a maximum yield point would be the quadratic form in (8) The isocline family could have a pair defining definite ridgelines and would intersect both axes. These points can be illustrated by

$$(8) \qquad Y = a + bX + cZ + dX^2 + eZ^2 + fXZ$$

setting the marginal rate of substitution to equal the relevant constant, k, in (9) and deriving the isocline equation as in (10). The variable X again can be defined as a linear

$$(9) \qquad \frac{\partial X}{\partial Z} = - \frac{c + 2eZ + fX}{b + 2dX + fZ} = - k$$

$$(10) \qquad X = \frac{kb - c}{f - 2kd} + \left(\frac{k - 2e}{f - 2kd} \right) Z$$

function of Z, with the isoclines intersecting the X axis if the constant $\frac{kb - c}{f - 2kd}$ is positive, and through the Z axis if it is negative. Since the isoclines do not pass through the origin, some product may be forthcoming by adding X alone or by adding Z alone.

If no product is forthcoming for zero inputs of factors X and Z, but a converging family of isoclines is still needed, a square root function such as in equation (11) may be more appropriate.

$$(11) \qquad Y = a + bX + cZ + d\sqrt{X} + e\sqrt{Z} + f\sqrt{XZ}$$

The point again is illustrated by setting the marginal rate of substitution to equal a constant k, and deriving the equation of the isocline family as in (12) and (13). Obviously, the isoclines will no longer be straight lines but are curved and can "bend together" or converge, both at the point of maximum yield and at the origin with zero input of factors.

$$(12) \quad \frac{\partial X}{\partial Z} = -\frac{c + .5eZ^{-.5} + .5fX^{.5}Z^{-.5}}{b + .5dX^{-.5} + .5fX^{.5}Z^{.5}} = -k$$

$$(13) \quad X = \left[\frac{kb - c - 5eZ^{-.5}}{fZ^{-.5}} \right.$$
$$\left. \pm \sqrt{\frac{kd + kfZ^{.5}}{fZ^{-.5}} + \left(\frac{kb - c - .5eZ^{-.5}}{fZ^{-.5}} \right)^2} \right]^2$$

In relation to logic and previous knowledge

Interpretation has been made of the characteristics of only a few functions. However, the few characteristics and functions presented illustrate that the fitting of functions need not be done blindly and that added properties can aid in selection of appropriate functions. The points explained can be further illustrated by means of Figure 1.

Figure 1 illustrates two possibilities (disregard the dotted and dashed lines within the graphs for the present) in respect to (say) crop fertilization. The isoclines could represent a soil about "equally deficient" in two nutrients. Hence, the isoclines (curved solid lines passing through the origin) form a "symmetrical" pattern because of the zero or very low level of nutrients in the soil.
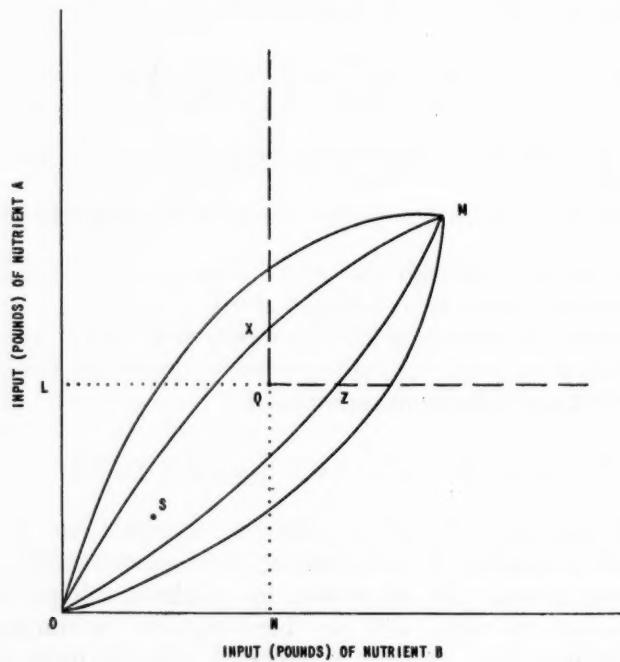
FIGURE 1

For a soil that is highly deficient in two nutrients, the production function equation should allow these curvature characteristics of the isoclines. Except for perhaps a pure sand, some quantity of the elements ordinarily will be available in the soil. In other words, a soil test might indicate that the "original starting point" (quantity of available nutrients in the soil) is that denoted by the point S in Figure 1. The soil would still be relatively limited in the two nutrients, however, and the family of isoclines would likely be curved. The square-root production function, equation (11) allows this characteristic because of the shape of its isoclines expressed in (13).

Suppose, however, that some quantity of both nutrients A and B are available in the soil, before addition of fertilizer for the plant. Then a new origin is relevent rather than a family of isoquants and isoclines beginning with the origin denoted as O in Figure 1. This is denoted as Q and the relevant axes are the broken lines. In other words, the available amount of nutrient A is OL and the available amount of nutrient B is ON. A quantitatively accurate soil test would indicate these quantities, denoting that the fertilizer response surface, predicted from fertilizer application, starts from point Q, rather than from point O, in the nutrient plane. In a regression equation including soil-test quantities as observations, coefficients for nutrients already in the soil would be based on quantities ON of B and OL of A. (By including nutrients already in the soil as variables in the regression equation, better knowledge of the production surface and isocline family should develop.)

In cases where the nutrient content of the soil is relatively high, however, and soil-contained nutrients are not employed in the estimates, the production function used for estimating may not provide nonlinear isoclines for the added nutrients. The relevant isoclines to be predicted for the added nutrients are those above and to the right of the dashed axes (with origin Q) in Figure 1. Although these portions of the isoclines are curved, the curvature is not great enough to show up in the production function equations. The best-fitting production function may then provide a family of linear isoclines such as those expressed in equation (8) for the quadratic form. They intersect at M, the maximum yield per acre. Also, since they are linear and do not intersect the origin, they denote, like those expressed in (13), that the least-cost nutrient ratio changes as higher yields are attained.

Knowledge of the situation and existing biological logic can be used to indicate the types of functions appropriate in cases such as these. Experimental designs might be fashioned accordingly.

STATISTICAL PROBLEMS OF JOINT RESEARCH*

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Introduction

STATISTICS has been defined as the science of uncertain inductive inference. Hence, a discussion under the subject of statistical problems of joint research, as cast under the general topic of "Economic Implications of Agricultural Experiments" must deal basically with the problem of making inferences—specifically inferences dealing with economic decisions, in which experimental data are involved. A basic assumption is that these inferences are in the form of optimal decisions, or leading to optimal decisions. The nature and quality of such inferences depend, first of all, upon the thinking behind the planning of experiments, as well as on their proper execution and basic interpretation. When these experiments are part of a joint research project, statistical problems likely will be compounded, for regardless of the singleness of the prime objective, specific secondary objectives related to the individual components of the joint effort are almost certain to be included.

The purpose of this discussion is to examine the basis for what might be termed problem areas in the joint research effort between economists and agronomists, soil scientists, animal scientists, and other related areas, and to suggest a few general approaches to some of these problems to make them more tractable. Some of the broader and more general problems will be discussed, since these must be well understood before useful solutions of more specific problems can be made. This discussion is much in the nature of a review, since most of the specific statistical problems have been treated in detail by writers who will be referred to in the appropriate sections.

Historical

Experimentation has been a primary tool in the application of the scientific method in the agricultural sciences. The art and science of experimentation has developed rapidly in all areas of research over the past 40 years, and the agricultural (or biological) sciences have led the way in many if not most areas. One reason for this is that variation is a distinguishing feature in observing biological processes or responses. The "modern" experiment utilizing specific statistical principles in its planning and design was first extensively employed in agriculture. Much

of the credit for such development must go to R. A. Fisher. One of his basic contributions was the clear elucidation of the principle that the plan and design of an experiment determines the form of the statistical analysis; i.e., the inferences (tests of hypothesis and estimates) that may be made from the data. This is a point on which a reminder is often needed, even today.

Yates and Cochran (16) in 1938, in discussing the analysis of groups of experiments, set forth some basic principles which have subsequently been both refined and "rediscovered" by several workers in this area of effort. Some of their concepts will be reviewed in the following sections.

For purposes of delineating our area of interest in agricultural experiments, we are mainly concerned with those whose primary aim is technical, rather than scientific. We define experiments whose aim is scientific as those concerned with the elucidation of some underlying law, i.e., to broaden the base of our knowledge and understanding of the physical and biological phenomena. Experiments whose primary aim is technical are defined as those designed to yield information or empirical rules for the conduct of practical agriculture. Included under those with technical objectives would be such experiments as crop variety tests, certain types of feeding trials with animals, fertilizer-rate studies with crops, efficiency tests of different types and operating methods of farm equipment in agricultural engineering. All of these types of experiments have direct economic implications and objectives, whether or not they are given proper economic analysis and interpretation.

These two aims (technical and scientific) in experimentation are not mutually exclusive. Generally, well-conducted technical experiments serve to add to the structure of the general scientific law, or at least to indicate where the existing structure is inadequate, while experiments on questions of a more fundamental nature will themselves provide the foundation for further technical advance. For example, fundamental laboratory and greenhouse studies on the mechanism of uptake of a particular plant nutrient may have little practical or economic application, but definition and characterization of the mechanism may suggest the use of a more efficient form and placement of the nutrient in the form of fertilizer. On the other hand, the need for such a fundamental study may have been suggested in a field fertilizer experiment, by observation of variations in efficiencies under different physical or chemical environments.

Statistical Problems in Planning Experiments

Box and Hunter (3) state that, "It has been remarked that the only time an experiment can be properly designed is after it has been com-

pleted. The more one considers this paradoxical statement, the more one realizes that it is true. It is not uncommon to find after a set of experiments have been made (a) that one or more important variable has probably been overlooked, (b) that more could have been learned if the factors could have been varied over different ranges, (c) that some transformation of the variables would have been more appropriate, (d) that some more elaborate pattern of experiments is needed to elucidate the situation."

This statement itself suggests at least four major problem areas to which careful attention must be paid. Although the following discussion does not follow the pattern outlined in the statement of Box and Hunter, some aspects of the statement will be covered.

The sampling of the population over which inferences are to be made

Results from an economic analysis partially based upon experiments, must be capable of some generalization in terms of furnishing information for decision, or as a basis for recommendation to farmers. The degree of generalization depends upon the nature of the population, and upon the kinds of information we have about the population. The net result is that seldom are any recommendations made upon the basis of a single experiment. Some of the major considerations and problems of making experimental inferences from a group of experiments is discussed by Yates and Cochran (16) and Monroe and Mason (14). An elaboration of some of the problems discussed in the following section may be found in these two papers.

First, we must view an individual experiment, e.g., on a single site or on a given number of animals, as an observation from a sample of the population with which we are concerned. The first problem, then, is that of defining and delimiting the population. We might say that many of our statistical problems have their origin here. It is not uncommon to review a research project that deals with a very restricted population of experimental material, yet the objectives imply that inferences can be drawn concerning an almost unlimited population. If we are concerned with field-crop experiments, we must carefully specify the geographical area, the soils within the area, the levels of cultural practices and other factors that are not included as actual treatment variables. In this aspect, we need to think more in terms of sample survey theory, in delimiting our populations, and planning the number of observations (experiments) required to constitute an "adequate" sample of that population.

The responses or treatment differences may, and usually do, vary from place to place, time to time, or with a number of other factors. In

addition to the variability inherent in the experimental material, and measurable in an individual experiment, called "experimental error," we often find variation in responses that can be arbitrarily classified into three categories:

(a) that for which the causes are known (or can be inferred) and for which we can predict the future incidence of these causes,

(b) that for which the causes are known (or can be inferred) but we cannot predict their future incidence, and

(c) variability for which the causes are unknown.

TABLE I. PARAMETER ESTIMATES AND THEIR VARIANCES AS ESTIMATED ON 6 NORFOLK-LIKE SOILS, FOR RESPONSE OF CORN TO N(X₁), P₂O₅(X₂), AND K₂O(X₃). (FROM HURST AND MASON (9).)

Parameter	Location number						Observed $s^2(b_{ii})$	Theoretical $V(b_{ii})$	Test (X^2) 5 d.f.
	51	52	53	55	57	58			
β_{ii}									
b_{0}	81.317	86.447	93.222	92.264	59.686	51.536	310.24	19.67	15.77**
b_{1}	9.562	4.298	9.908	14.964	3.444	.175	28.99	1.58	18.35**
b_{2}	.272	.114	−1.139	1.977	1.075	−.428	1.21	1.58	.77 N.S.
b_{3}	−.159	.780	1.270	−.714	−1.428	−2.097	1.66	1.58	1.05 N.S.
b_{11}	−8.005	−4.818	−7.566	−9.120	−6.014	−3.658	4.28	2.28	1.88 N.S.
b_{22}	−1.846	−.581	−.031	−1.408	1.092	−1.761	1.32	2.28	.58 N.S.
b_{33}	−1.655	−.918	−.296	−.802	.649	−.423	.59	2.28	.26 N.S.
b_{12}	1.181	−1.066	.641	.953	2.481	2.262	1.64	3.16	.52 N.S.
b_{13}	1.175	−.847	.778	1.234	−3.775	.850	3.83	3.16	1.21 N.S.
b_{23}	−.950	−.916	−.509	−3.041	−1.137	−1.100	.80	3.16	.25 N.S.
							Average M.S.E. (252 d.f.)		
M.S. Error	100.12	104.17	89.11	91.58	117.63	104.44	101.175		

The variability in experimental material, e.g., soils, animals, etc., which is known and predictable before the experiments are run, may be used as a basis for stratification and allotment of the experiments to the strata. This carries an implication that different production functions will be developed for the strata, or that the variation will be accounted for by the addition of one or more constants to the function. This sort of variation is indicated in Table I. This constitutes a portion of one year's data from a pilot project cooperative with TVA on determining the NPK response surface for corn on two soil types in Eastern North Carolina. It was predicted that different responses would be obtained with differing levels of residual nutrients in the soil. Proposals for accounting for these differences in the function have been made by Hurst and Mason (9), and by Hildreth (8).

Table II gives an example of variation in response due to (b) factors whose effects are known, but whose occurrence cannot be predicted. (These functions—response of corn to Nitrogen in "Good" and "Dry" weather in N.C.). With all our study of meteorology, we still cannot pre-

dict whether next year will be wet or dry. One view in handling this sort of variation is that recommendations for future practice be based on average effects, provided the experiments have sampled "representative" seasons, or weighted averages based on a study of the distribution of past weather. This obviously implies that the function will be optimum for any given year only by accident, but on the average will be "best," since the loss incurred in the dry years will be offset, or compensated for, in years favorable to the fertilizer.

Many possibilities exist from the economic side for looking at this problem. We have some reason to believe that farmers in general do not use recommended rates of fertilizer because the loss in dry years is

Table II. Effect of Weather on Response of Corn to Nitrogen in North Carolina. (From Johnson (12).)

Weather Condition	Polynomial equation*	First derivative
"Good"	$\widehat{Y}=25.16+15.19X-0.836X^2$	$dY/dX=15.19-1.67X$
"Dry"	$\widehat{Y}=15.40+13.80X-1.16X^2$	$dY/dX=13.80-2.32X$

* X = 20 lb. units of nitrogen.

greater than the expected gain in favorable years. Some weighting of the function, based on frequency of occurrence of the event and gain with alternative practices might make for a more realistic function from an economic standpoint, since the net loss from the last, say, 40 lbs. of fertilizer applied in a dry year, may be more than the comparable gain in a favorable year. Other economic factors such as the state of the farmer's resources in terms of his capacity to incur risk, the value of the outputs, his opportunity for alternative use of capital in other enterprises, are also important.

In summary, any prior information in the form of knowledge of factors that are known to affect response, and whose occurrence or frequency may be predicted, should be used in designing the location and number of the experiments. Apart from that and ideally the experiments should be assigned at random from all fields that are to be covered in the subsequent investigations. This will provide an unbiased estimate of the means and variances of the treatment responses. Random selection does not preclude subsequent differential recommendations on the basis of effects of factors not previously visualized as important. To view the problem realistically, however, it is almost impossible to choose a random set of experimental sites. For various reasons one usually has to be satisfied with what can at best be termed "representative" sites. Estimates

of the means may be actually improved by systematic selection, but the estimates of the variances are affected. Caution must be exercised in analyzing (and making inferences) from data from sites chosen in a systematic manner, as if they were randomly located.

The choice of a proper functional model to describe the form of response

The question of the choice of the proper model for describing the response curve or surface in fertilizer experiments has been reviewed in a number of recent papers, including Heady, et al. (6), Anderson (2), Mason (13), Hutton (10) and Ibach (11). Hildreth (7) has discussed the use of discrete models with qualitative restrictions, and Anderson (1) has discussed in detail the comparison of discrete and continuous models in agricultural production analysis. Johnson (7) has discussed the desirable characteristics of experiments with respect to models. Even a cursory review of the pertinent items in these discussions would consume more than the allotted time for this discussion. However, a few salient summary points should be emphasized.

(a) In most areas of agricultural experimentation the functional form is not known, or it may be reasoned that if it were known, it would be too complex to treat reasonably. However, we should continually examine accumulated evidence for clues to the true form, or closer approximations to it. The advent of the high-speed computer opens new vistas, particularly in areas of nonlinear estimation where iterative procedures must be used.

(b) The experimental design (in terms of the treatment levels or treatment combinations) can be chosen most efficiently if the functional form, or some form that will yield a "reasonable" approximation to it, is known. A design that will allow the fitting of several alternative functions is generally not optimal (in terms of information per experimental unit) for any one of the forms.

(c) As pointed out by Anderson (2), a given model may not be advisable if a more simple one will give a reasonably good fit to the experimental data. A model that is complicated unduly to fit a given set of data is likely to suffer more shrinkage of the correlation coefficient than a simpler model based on general considerations (such as theory or previous experience), and not entirely on the data being fitted. This problem has not been thoroughly investigated, and Anderson suggests approaches to determining some of the consequences in simplyifying models.

(d) The common criteria used in testing consistency between the functional model and the observations are (1) conformity to known laws of biological behavior and (2) goodness of fit, is indicated by the relative size of the lack of fit or model-error mean square as compared to the

experimental-error mean square, or the size of the correlation coefficient. Many such comparisons (6), (11), (12) have been made. Table III-A indicates this type of comparison. This table seems to give no indication of preference of one function over the other, from a statistical standpoint. For use as a prediction equation, one would seem to work as well as another. The one for which it is easiest to perform the fitting computations would likely be chosen.

The production economist, however, is using the equation as a production function. He will use it to estimate optimal rates or levels under various economic situations or assumptions. He is interested in the first derivative (the marginal product) representing the rate at which the input is transformed into product. An estimate of the optimal input can be obtained by equating the first derivative to the price ratio (ratio of unit cost of input to unit price of output) and solving for the input value that satisfies the equation. Table III-B shows a series of solutions for several functions derived from the same data. Considerably more variation exists among the estimated optima for the various functions than between the estimated values of yield.

TABLE III. COMPARISON OF PRODUCTION FUNCTIONS COMPUTED FROM IOWA CORN DATA AND OMITTING 0 LEVELS. (EXTRACTED FROM TABLES II AND III, ANDERSON (2).)

A. Estimated mean corn yields (bu/acre)

Function	Level of nitrogen (in pounds)								$S(y-\hat{y})^2$
	40	80	120	160	200	240	280	320	
Observed*	88.4	105.4	128.8	123.0	110.6	127.4	133.1	129.2	
Mitscherlich	97.6	105.5	112.2	117.9	122.8	126.9	130.4	133.3	559
Cobb-Douglas	94.8	105.9	113.1	118.4	122.7	126.4	129.5	132.3	479
Quadratic	94.0	105.1	114.1	121.0	125.9	128.6	129.3	127.9	501
Square Root	90.6	106.9	116.3	122.2	125.7	127.6	128.3	128.1	416
Quad. Sq. Root	87.4	111.4	119.4	121.8	122.6	123.9	126.9	132.4	332

B. Estimated Optimal Nitrogen Applications (in pounds) for Various Input-output Price Ratios as Derived by Various Production Functions for Iowa Data.

Function	r = Nitrogen-corn price ratios (pound/bushel)					
	.04	.08	.12	.16	.20	.24
Mitscherlich	450†	281	182	111	57	12
Cobb-Douglas	588†	256	158	112	86	69
Quadratic	243	212	181	150	120	89
Square Root	228	188	156	131	113	97
Quad. Sq. Root	185	149	136	125	117	110

* Average of two yields.

† These fertilization rates are beyond the limits of the experimental data and should be discarded.

TABLE IV. CONFIDENCE INTERVALS (80%) FOR ESTIMATED OPTIMAL RATES OF N, COMPUTED FROM THE QUADRATIC EQUATION ($Y = 80.77 + 14.22N - 1.04N^2$) REFERRED TO IN TABLE III, FOR VARIOUS PRICE RATIOS

Pn/Pc	Optimal est. N(lbs./acre)	80% limits for lbs. N	
		Lower	Upper
.04	243	203	604
.08	212	177	409
.12	181	118	247
.16	150	− 39	184
.20	120	−234	158
.24	89	−434	138

This estimate of the optimum is a mathematical estimate, however, and not a statistical estimate. The profit surface in the region of the optimum rate is likely to be relatively flat, and small changes in the position of the curve will change the optimum-rate estimate considerably. One might expect that these estimated optima would have comparatively wide confidence limits. Anderson (2) has computed these 80% confidence limits for the setimates for several price ratios, and these are given in Table IV. Even the 80% limits enclose most of the estimates made by the other functions.

Table V gives the estimated yields for the optimum rates, at several price ratios for the several functions. The variations among these estimated values are very small, compared to the relatively wide variation in optimum rates and the wide confidence intervals (not shown) of the estimated yield and optimum rates.

In summary, devoting more effort to looking at the confidence intervals of our estimated optima would appear well worthwhile as an aid in interpretation. Box and Hunter (4) present a procedure for estimating confidence regions through a generalization of Fiellers theorem. It seems a shame to apply statistical principles throughout the design and the analysis of the data, and to stop just short of the ultimate and accept the point estimate as the final answer. In some areas this variation may

TABLE V. ESTIMATED CORN YIELDS (BU./ACRE) FROM ECONOMIC OPTIMAL RATES OF N (TABLE IV)

Estimating equation	Nitrogen—corn-price ratio				
	.08	.12	.16	.20	.24
Mitscherlich	130	121	111	101	91
Cobb-Douglas	128	118	112	107	104
Square Root	125	122	118	115	112
Quad. Sq. Root	121	121	120	119	118
Quadratic	127	124	120	114	107

have more practical importance than in others. In fertilizer experiments as mentioned previously, for example, if the profit in applying the last 40 pounds of N is very small, we would likely accept on the average a small loss, rather than incur the risk of heavier losses in dry years.

(e) In the problem of choice of proper scale or transformation, often a simpler model could be used, and at the same time the statistical assumptions would be better met if the proper scale were used. In bioassay, for example, standard methods for transformation of dosage and response to such a scale that the response curve is linear, greatly simplifies the estimation problem. Numerous examples exist in biological and other literature. Moore, et al. (17) in investigating the response surface of lettuce to various minor elements, scaled the rates to a log scale. Heady,

TABLE VI. COMPARISON OF ORDINARY AND SQUARE-ROOT SCALE FOR X VARIABLES ON FIVE EXPERIMENTS ON RESPONSE OF CORN TO N, P AND K

Source of variation	d.f.	Location									
		1		2		3		4		5	
		M.S. Ord.[1]	M.S. $\sqrt{}$ [2]	M.S. Ord.	M.S. $\sqrt{}$	M.S. Ord.	M.S. $\sqrt{}$	M.S. Ord.	M.S. $\sqrt{}$	M.S. Ord.	M.S. $\sqrt{}$
Linear terms	3	488.2	621.1	1694.8	2514.6	1278.8	1870.9	321.2	848.6	4871.2	6256.0
Quadratic terms	6	176.2	150.6	489.7	233.5	363.7	153.2	811.4	627.1	1116.9	222.2
Lack of fit	5	60.2	11.20	195.0†	10.59	256.2†	153.2*	258.2	162.9	48.7	291.4*
Experimental error	42	60.9	60.9	51.8	51.8	50.1	50.1	117.6	117.6	91.6	91.6

* $Y = b_0 + b_1N + b_2P + b_3K + b_{11}N^2 + b_{22}P^2 + b_{33}K^2 + b_{12}NP + b_{13}NK + b_{23}PK$

† $Y = b_0 + b_1\sqrt{N} + b_2\sqrt{P} + b_3\sqrt{K} + b_{11}N + b_{22}P + b_{33}K + b_{12}\sqrt{NP} + b_{13}\sqrt{NK} + b_{23}\sqrt{PK}$

et al. (6) have reported that a square root transformation of the independent variables in corn yields to N and P_2O_5 applications gave an apparent improvement in fit.

Table VI shows a comparison of a straight-scale second-degree equation, from NPK experiments with corn, and the square-root counterpart. Out of the 5 experiments, the square-root transformation reduced the lack-of-fit mean square in four of them and increased it in one. Studies are under way to make a more complete evaluation of scale in the larger series of experiments, of which these are a part. Knowing the proper scale is desirable in planning the treatment levels in the experiment.

Planning the Economic Amount of Experimentation

A most realistic problem that must be found in joint research is that of determining the amount of effort, in terms of cost, or size and number of experiments, that is optimal for a given problem. From an administrative point of view, some proposal must be submitted in the project plans on the cost of experimentation. Considerable attention has been paid to estimation of the size of individual experiments required

for certain limits of error, or to measure differences of a given magnitude, given a measure of variation in the experiment such as percent standard error, and the significance levels desired for the test. Where a decision to adopt a new practice on a wide scale or to change existing practices depends on the outcome of the experimental program, the problem is that a different approach involving elements of decision theory must be used.

Yates (15) suggests that the essentials of the problem are very similar to that of deciding the accuracy required in a sample survey. He proposes the general principle that the accuracy should be such that the sum of the cost of the survey and the expected losses due to errors in the results should be a minimum. In experimentation a real problem exists in estimating the expected losses due to a wrong decision, or to errors in estimating economic optima. Yates suggested a general approach to the problem, but provided no objective means of estimating expected loss.

Grundy, Healy and Rees (5) of Rothamsted have explored the question further and have given a solution to a simple version of the problem when the decision is to be made whether or not to adopt a new process or practice. Their solution requires that the experiments be done in two stages. The results of the first stage are used to estimate the expected gain due to the new practice, or conversely, the expected loss due to failure of adoption. At the end of the first stage, it may be decided to accept or reject the new practice, or a decision may be postponed until the results of the second stage, whose extent will be estimated from the first stage, are complete. The authors point out the limitations of their method, among which are (a) the results can be applied only when economic considerations are of over-riding importance, and (b) the fact that they can deal with only a single parameter (e.g. comparison of two treatments), whereas especially in agricultural experiments, the problem is usually more complex. The contribution of the work appears to be considerable, however, even if it serves primarily to point up the problems and need for further work in this area, and to stimulate additional research into the subject.

Summary of Additional Problem Areas

The following summary statements point to some of the areas of statistical problems not covered in the paper:

1. Some problems associated with how to best extract information from existing experimental data.
2. Specific problems in the design and arrangements of treatments in experiments.

3. Difficult problems, from a technique standpoint, associated with specific subject-matter areas, e.g. estimation of residual effects, and rotation experiments, quality of product evaluation in both plant and animal experimentation.

4. The fact that in some areas of research, such as those requiring a sampling of years, agricultural experiments must extend over a period of time such that, in the meanwhile, there have been developed new breeds of animals, new crop varieties, even a changing pattern in consumer demand, as for example, the flue-cured tobacco industry has experienced. This introduces very difficult statistical problems, as well as problems in the other disciplines.

Finally, it is well to reemphasize that time spent in planning, always viewing the realistic objectives of the joint project, will do much to help solve the problems of making inferences.

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PROBLEMS OF APPLYING EXPERIMENTAL RESULTS TO COMMERCIAL PRACTICE

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FARMERS frequently remark that although results reported by agricultural experiment stations show adoption of a given practice to be profitable, conditions on the farm are sufficiently different from experimental conditions to render the results unreliable for planning operations on the farm.[1] There is some foundation for this attitude and in some cases this is an accurate appraisal of the problem. On the other hand, research workers sometimes dismiss the problem of translating experimental results to farm situations by simply stating that experiments deal with "relationships." Although experimental conditions are not duplicated on the farm, they argue that the "relationships" still hold and that is what matters.

First I wish to indicate in a rather general way the classes of problems encountered in transferring experimental results to farm conditions. We have reference to those experiments intended to have rather direct application to farm conditions. Many experiments deal with more fundamental relationships, knowledge of which is a necessary prerequisite to formulating meaningful hypotheses useful in designing experiments to yield relationships of more direct consequence in the choices farmers make.

Consider the following relationship estimated from an experiment designed to aid in an immediate fashion in making recommendations to farmers: $y = f(X_j, Z_k, e)$ where y is the product or output X_j are the inputs treated as experimental variables (which may or may not be chosen deliberately), Z_k the "conditions" under which the experiment is conducted which are different from those on commercial farms (the effect of Z_k is not studied), and e the unexplained residual. Let us first concentrate on two general classes of problems within a framework built on the assumption that the unexplained residuals are so small that they can be neglected (not an uncommon implicit assumption underlying recommendations). Two classes suggest themselves:

I. $\partial y/\partial f_j$ independent of Z_k
II. $\partial y/\partial x_j$ functions of Z_k

In Class I, the economic choice of an optimum point on the y, x_j

[1] A bibliography of research on social factors in the adoption of farm practice has been prepared by the North-Central Rural Sociology Committee: bibliographical supplement to "How Farm People Accept New Ideas," Iowa State College, Ames, Iowa, April 1956.

surface would not be affected by the change in levels of z_k as we transfer
the result from experimental conditions to a farm. Optimum levels of
inputs can be determined by equating the partial derivative in Class I
to the ratio of the price of X_j to the price of y. The absolute level of
profit (or loss) would, of course, depend, among other things, on the
levels of Z_k and their costs.

Intuitively it would seem that this pure case of independence is not
very important. Rather, we are more apt to find Class II, i.e., the margi-
nal conditions for profit maximization to be affected by change from
experimental to farm conditions. We might mention one special case
under Class II above. Although the optimum level of production for y
is affected by changes in z_k, substitution rates between the x_j may not
be affected by such changes in z_k. This case is typified by the unmodi-
fied Cobb-Douglas function. The substitution rates $\partial x_i / \partial x_j$ $(i \neq j)$ do
not depend on the level of z_k. This subclass could include certain live-
stock ration recommendations.

We would indeed be most fortunate if the effects of differences in
experimental and farm conditions were additive (Class I), less fortunate
if at least some substitution rates were not affected, and least fortunate
where the shape of the y, x_j surface changes drastically as we transfer
the relation to a farm situation.

Whether transformation rates of inputs into product and substitution
rates among inputs (or products) are substantially independent of dif-
ferences between experimental conditions and farm conditions is, of
course, an empirical question. This is a question, however, about which
extension and farm management workers make judgments almost every
time a recommendation based on experimentation is made. The heavy
reliance that many extension workers place on informal observation of
practices used by farmers in making recommendations is testimony to
the fact that many experiments are difficult to interpret.

The problem of evaluating the necessary modification of experimental
results for farm use is, of course, profoundly affected by the design of
the experiment. This is a point that need not be labored here.[2] The two
previous papers in this session have addressed themselves to this topic.
The ideal solution is to get the experimenter to study the relationships
involving the z_k variables. Limitations of resources available to agricul-
tural experiment stations make necessary the narrowing of the relation-
ships to be studied. In some cases, however, these relationships involv-
ing z_k need not be estimated. It may be sufficient, for example, to select
materials (e.g., animals, soil fertility levels) from populations more fre-

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[2] See e.g., chapters 1-6 and 9 and 10 of E. L. Baum, et al., *Economic Analysis of Fertilizer Use Data*, Iowa State College Press: Ames, 1956.

quently found on actual farms. The general high level of cultural practices in agronomic experiments or "management" in livestock experiments need only be mentioned as factors increasing the difficulty of transferring experimental results to commercial practice. As technologists, statisticians, and economists learn to understand one another's viewpoints, we should expect increasing progress in lessening the difficulties of interpreting experiments for farm situations. However, in the interim we are called upon to make recommendations of some sort.

How can the necessary adjustments be approximated for farm purposes? Experimental farm management units might appear to be a logical solution. This was suggested frequently about 25 years ago and the idea has recently been studied by the Southern Farm Management Research Committee.[3] This group concluded that the principal value of units of this nature is demonstrational. Costs would be prohibitive if we were to have strictly economic research units.

The judgment of the experimenter himself is usually the most reliable means of obtaining needed adjustments. Guides from farm observations can be of aid, however, in helping the experimenter make such adjustments. An example of estimating this type of guide is found in a publication of Rust and Odell.[4] Multiple regression analysis was used in studying crop production on major Illinois soils on about 700 farms over a period of years. The independent variables studied in relation to corn yield were rainfall, the mean of daily maximum temperatures for the period July 1 to August 31, nitrogen applied in current year, nitrogen applied in the previous year, pounds of P_2O_5 and K_2O applied in current year plus an estimate of carryover, an index of the kind and frequency with which legume and legume-grass mixtures were grown preceding the corn crop, and time. The authors indicate that the primary purpose of the analysis is to determine relative yield productivity and not to predict the net effect of individual management factors on crop yield. When treatments and weather conditions were made as comparable as possible on the Elliott-Ashkum soil, crop yields under farm conditions were about 80 to 90 percent, depending on the crop, of those in the experiment field.[5] This does not suggest that a blanket figure can be taken for adjusting all experimental results on a given soil for a given crop. A

[3] Limitations and Contributions of Pilot Farms, Management Units, or Experimental Units in an Economic Research Program, Mimeo., Southern Farm Management Research Committee, March 1954.

[4] R. H. Rust and R. T. Odell, "Methods Used in Evaluating the Productivity of Some Illinois Soils," *Soil Science Society of America*, Proceedings, Volume 21, Number 2, 171-175. March-April 1957.

[5] R. T. Odell, "The Productivity of Dark, Till-Derived Soils in Northeastern Illinois," *Agronomy Facts*, University of Illinois, College of Agriculture, January 1956.

study of this nature can only give us benchmarks. In developing yield estimates for budgeting on Muscatine and Tama soils,[6] agronomists adjusted the level of yields from experimental data with the aid of the cited study. Sole reliance was not placed on the regression estimated from the farm data; it served only as a guide.

Another example of adjustment of agronomic data is given in two fertilizer response curves presented in "Profitable Use of Fertilizer in the Midwest."[7] One curve is for current level of yield-influencing practices and another for an improved level.

Adjusting experimental data to reflect a variety of combinations of products and inputs likely to be encountered by a farm operator is sometimes instructive. The effect of such adjustments (a) on level of profitability of the farm as a unit and (b) on optimal levels of the enterprise considered and of other enterprises may be conveniently studied within a linear programming model.[8] Consider a simple programming model in which each process or activity is essentially what we commonly call an enterprise. In this kind of a model we may examine the effects of altering the production coefficients, within what is believed to be a relevant range, by obtaining a separate solution for each alternative combination of coefficients. If by examining these alternatives through rather wide ranges of variation in production coefficients, we find that the optimum combination of enterprises remains substantially the same, we can be more confident that the adjustments in coefficients from experimental data are not critical in terms of what has traditionally been called the system of farming. Even though the optimal system of farming is insensitive to wide variations in selected input coefficients, profits may be seriously affected. If so, added knowledge of the exact form of the production relationship needs to be gained by appropriate experiments. If, on the other hand, profits are not substantially affected by these arbitrary shifts in the coefficients, more precise knowledge of the production relationship will not be crucial. Two cautions should be mentioned regarding this kind of approximative procedure for studying adjustments of experimental data. First, the nature of the programming model itself must be such that, if wide variations in size of coefficients do not change optimal organization or profit level or both, this insensitivity is not due to some peculiarity of the model itself. If the variables

[6] G. A. Peterson and Earl R. Swanson, *Highest-Return Farming Systems for Tama and Muscatine Soils*, Illinois Agricultural Experiment Station Bulletin 602, 1956, p. 5.

[7] North Central Regional Publication No. 54, University of Wisconsin Agricultural Experiment Station Bulletin 508, December 1954, p. 21.

[8] See G. A. Peterson and Earl R. Swanson, *op. cit.*, p. 14, for an example of studying the effects on the optimal farm plan of varying the feed-to-gain ratio in livestock production.

differing between experiment and farm are changed, care must be taken
to insure that associated costs are taken into account.

When we shift emphasis in the general area of applying experimental
data to farm situations from the changes in *form* of the function to its
variability, we find the problem much more difficult. For purposes of
discussion, I would like to distinguish two approaches that one might
take. First, one might simply outline the alternatives in terms of the
parameters of the probability distribution. In many cases, the distribu-
tion of the experimental error is not the most appropriate basis for this
determination. In crop production, for example, the results of an experi-
ment for one or a few years may need adjustment to construct a more
appropriate distribution representing weather effects over a longer time
period. Here again the adjustment should be made by the research
worker familiar with the phenomena studied. Although this first ap-
proach (e.g., simply outlining alternative combinations of, say, average
level of income and risk) may lead to a large number of alternatives to
be presented, serious attempts should be made to give notions of relative
risk involved with alternative practices and the various levels of a given
practice. Before adopting a practice, farmers make some such evaluation.
Reporting only averages of the variables observed in an experiment may
create false impressions.

A second approach that one might take is to narrow the choices or
tailor them more specifically to given individuals. We are hopeful that
the Interstate Managerial Study will yield insights into this problem.[9]
Favorable results from this study coupled with the approach to program-
ming reported by Babbar,[10] Tintner,[11] and Freund[12] should enable
progress in this area. The work of Freund, which involves the maximiza-
tion of a utility function, should prove useful as we (a) gain more knowl-
edge of the constant in the utility function that indicates aversion to risk
and (b) are better able to estimate the nature of the variability in experi-
mental data.

I would like to suggest that game theory[13] has an application in this
second type of approach. Its usefulness also depends on improved knowl-

[9] See "Progress and Problems in Decision Making Studies," *Journal of Farm Economics,* 37:1097-1125, December 1955.

[10] M. M. Babbar, "Distributions of Solutions of a Set of Linear Equations," *Journal of the American Statistical Association,* 5:854-869, 1955.

[11] Gerhard Tintner, "Stochastic Linear Programming," Second Symposium on Linear Programming, National Bureau of Standards, Washington, D.C., 1:197-227, 1955.

[12] Rudolf J. Freund, "The Introduction of Risk Into a Programming Model," *Econometrica,* 24:253-263, 1956.

[13] J. C. C. McKinsey, *Introduction to Theory of Games,* New York, McGraw-Hill, 1952, esp. ch. 13.

TABLE I. HYPOTHETICAL YIELD RESPONSE DATA

Variety and fertilizer	Bushels per acre in given season			
	I	II	III	IV
Variety A				
50 pounds fertilizer	61	67	55	33
100 pounds fertilizer	72	79	65	34
150 pounds fertilizer	78	90	63	35
Variety B				
50 pounds fertilizer	62	63	48	36
100 pounds fertilizer	65	74	68	46
150 pounds fertilizer	58	76	78	53

edge of properties of the utility function for individual farmers as well as better estimates of the distribution of technical coefficients. The following example is hypothetical but, I hope, suggestive. Use of game theory may be more appropriate, in some cases, than making recommendations based on simple averages. Game theory solutions are not arbitrary alternatives to an average relationship. Game solutions have specific interpretations.

Consider a factorial experiment involving two varieties of corn, A and B and three levels of fertilizer application: 50, 100, and 150 pounds per acre. The experiment has been carried on for four seasons, I, II, III and IV. The hypothetical yield response data are given in Table I.

From this yield table and assuming prices we may construct a payoff matrix which will indicate the profit to the farmer for each of his six "strategies" (two varieties and three fertilizer levels) under each type of season (I, II, III, and IV). Assume that corn sells for one dollar per bushel, that seed costs are five dollars per acre for variety A and three dollars per acre for variety B, and that fertilizer costs ten cents per pound. The payoff matrix is in Table II.

Although in the absence of other information, one might view the four seasons as equally probable; let us say that a climatologist indicates that,

TABLE II. PAYOFF MATRIX OF HYPOTHETICAL YIELD RESPONSES

Variety and fertilizer	Dollars per acre in given season			
	I	II	III	IV
Variety A				
50 pounds fertilizer	$51	$57	$45	$23
100 pounds fertilizer	57	64	50	19
150 pounds fertilizer	58	70	48	15
Variety B				
50 pounds fertilizer	54	55	40	28
100 pounds fertilizer	52	61	55	33
150 pounds fertilizer	40	58	60	35

in general, the four seasons will occur with the following approximate frequencies: Season I, 40 to 60 percent of the time; Season II, less than 25 percent; Season III, between 10 and 30 percent; and Season IV, less than 20 percent. With this information the problem may be formulated as a constrained game (man v. nature) and the optimal strategy for the farmer who wishes to employ the minimax principle can be determined.[14] Following of this principle will result in the maximization of the expected value of the payoff matrix to the farmer under the assumption that nature will be as unfavorable to him as permitted by the frequency constraints. In this particular case, the optimal farmer strategy is Variety B with 100 pounds of fertilizer. This strategy is in response to the most unfavorable set of nature's strategies: Season I, 60 percent; Season III, 20 percent; and Season IV, 20 percent. The optimal farmer strategy need not, in general, be a single or "pure" strategy. Rather, the minimax solution may require strategy selection to be done by a randomization device.

The expected value for Variety B with a 100-pound fertilizer application is $48.80. The solution resulting from the use of the simplex method not only gives the optimal strategy for each player (farmer and nature) but also yields the differences between the expected value of the payoff matrix with the optimal farmer strategy and each of his alternative single strategies. The losses involved by following non-optimal strategies in the problem considered are:

Variety A

50	pounds fertilizer	$4.60
100	pounds fertilizer	0.80
150	pounds fertilizer	2.40

Variety B

50	pounds fertilizer	$2.80
150	pounds fertilizer	5.80

The minimax principle applied to a profit matrix as above has been attacked as being conservative. An alternative supposedly less subject to this criticism involves viewing the problem in terms of opportunity losses.[15] A "regret" matrix is formed by subtracting the highest profit in each column from the remaining profit figures in that column. For example, under Season I, the "regret" or opportunity loss by choosing

[14] Robert Dorfman, "Application of the Simplex Method to a Game Theory Problem," Chapter XXII in Tjalling (Koopmans, Ed.), *Activity Analysis of Production and Allocation*, New York: John Wiley and Sons, 1951.

[15] John Milnor, "Games Against Nature," Chapter IV in *Decision Processes* (edited by R. M. Thrall, et al.), New York, John Wiley and Sons, 1954.

Variety A with 50 pounds instead of Variety A with 150 pounds is $51 − $58 = − $7, etc. (see Table III).

TABLE III. REGRET MATRIX OF HYPOTHETICAL YIELD RESPONSES

Variety and fertilizer	Dollars per acre in given season			
	I	II	III	IV
Variety A				
50 pounds fertilizer	$− 7	$−13	$−15	$−12
100 pounds fertilizer	− 1	− 6	−10	−16
150 pounds fertilizer	0	0	−17	−20
Variety B				
50 pounds fertilizer	− 4	−15	−20	− 7
100 pounds fertilizer	− 6	− 9	− 5	− 2
150 pounds fertilizer	−18	−12	0	0

For each of nature's strategies (seasons) there is a maximum regret or opportunity loss that the farmer would incur if he followed the poorest strategy for a given season. Application of the minimax procedure insures that this type of loss will be minimized when all seasons are considered. In this case, let us place the same restrictions on the frequency of seasons as in the previous problem. It so happens that the optimal strategy for minimizing the maximum regret is also Variety B with 100 pounds of fertilizer. Again the choice among strategies was not restricted to pure cases; a mixed strategy might have resulted.

The expected regret is − $6.07 while the expected value of the original payoff matrix is $52.88. Nature's strategies in this solution are: Season I, 40 percent; Season II, 25 percent; Season III, 24 percent; and Season IV, 11 percent.

Other variations of the minimax technique may be employed. For example, farmers considering only the outcome for the ensuing year may wish to ignore the restraints on nature. If for any given set of data application of several criteria results in specification of a similar course of action, then confidence in the generality of the recommendations of that course of action might be presumed to increase. Even if a problem were not explicitly solved, placing certain experimental results in a game theory format will aid in discovering inadmissible strategies, i.e., ones that would yield inferior results irrespective of nature's action. Such a strategy is Variety A with 50 pounds of fertilizer in Table II. This strategy is inferior to Variety B with 100 pounds of fertilizer in all seasons considered and hence it could be eliminated prior to any calculations.

DISCUSSION: ECONOMIC IMPLICATIONS OF AGRICULTURAL EXPERIMENTS[*]

Glenn L. Johnson

Introduction

Controlled biological experiments designed jointly by physical agricultural scientists and production economists are of increasing importance in the land grant system. Extensive work is underway at my home station, in Ontario, at Kansas, in North Carolina, in Kentucky and elsewhere as well as at Ames. The Tennessee Valley Authority, the Agricultural Research Service and the Farm Foundation are examples of agencies which finance and encourage this type of work on an interstate basis. By and large, the work is being done by highly motivated personnel heavily committed to scientific values. One is also justified in asserting that this work has attracted the skills of some of the best technical scientists, statisticians and production economists in the nation.

Despite the formidable array of resources devoted to such research and an imposing array of results, however, considerable room exists for improving this effort. The chairman of this session is to be congratulated for arranging this timely and needed discussion. There are serious problems continuing to arise in applying results under farm conditions. Further, there are serious methodological problems that continue to cry out for attention. In this connection I am disappointed that more econometricians are not present at this *joint* meeting of the Econometric Society with the American Farm Economic Association.

Professor Heady spoke first about the problem of initiating cooperative input-output research. In the last half of his paper, he considered methodological problems. This last section of Heady's paper and Professor Swanson's and Mason's papers constitute something of a unit dealing with methodological issues involved in doing and applying this type of research.

Heady on Cooperation

Heady has given us some very clear insights into the techniques he employs in cooperating with technical scientists. Administrators in research extension and teaching, as well as research personnel, would do well to read his first section. By doing so, they could learn much about how "to make friends and influence people" while extending, but not sacrificing, the values that identify science and scientists.

It is worthwhile recapping the seven essentials for cooperation with

technical scientists as Heady sees them. The *first* essential is knowledge of relevant production economic concepts on the part of all involved. If this knowledge is present, then faith in production economists is not required. The *second* essential is genuine interest on the part of all concerned. The *third* is a willingness to sacrifice individual interest enough to engage in task-force research. The *fourth* is an absence of professional jealousy while the *fifth* is scientific objectivity and the *sixth* is a willingness to share the work load. The *seventh* and last requirement is that there be enough complementarity among the abilities of the different contributors to offset the costs of cooperating. My own experience, which includes both successes and failures in negotiating cooperative research, substantiates Heady's opinions almost completely. I might, however, stress a bit more than Heady does the role that administrative organization can play in these matters. Administrators, like scientists, are essential cooperators in task-force research. As cooperators, they, too, need to display the seven characteristics enumerated above. Further, as administrators, they play a particularly responsible role as the development of Heady's essential characteristics can be either encouraged or discouraged by administrative attitudes. Perhaps one of the greatest dangers to research, either by individuals or by task forces, is that the value system of science as expressed in Heady's seven essentials will be replaced by a philosophy that takes "what man does as what man ought to do." I refer to the increased emphasis on public relations. This emphasis tends to evaluate in terms of what the public thinks rather than in terms of the long-established, inner-directed, value system of science. Science involves the worth of knowledge, open mindedness, cooperativeness, factual objectivity and fairness, whether or not these values happen to be "popular" and, therefore, advantageous to espouse at any particular moment.[1]

On the Selection of Mathematical Functions

In discussing the problem of selecting functions, Heady mentioned but avoided discussing statistical criteria for selecting the best of alternative production functions. Instead, he concentrated on biological and economic data as a basis for selecting functions. Some of the data and information used in his illustrations were a priori while some were produced by the experiment under consideration. The selection process employed by Heady is, in fact, an informal blend of statistical and judgment procedures. Such a process, although praiseworthy from many standpoints, has the shortcoming of not necessarily producing the same decisions when duplicated by subsequent workers. This suggests the need

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[1] In this connection see David Riesman, et al., *The Lonely Crowd* (Doubleday Co., Inc., Garden City, New York), 1955.

for work on more objective processes for selecting alternative functions. At a later point in this paper, I shall suggest some alternatives that might prove somewhat more objective.

Swanson on the Application Technical-Economic Research

Swanson first placed major emphasis on the consequences of differences among the fixed conditions, as defined by values of his Z_k, in experimental conditions as contrasted with farm conditions. He discarded as trivial the case where marginal value productivities, $\frac{\partial y}{\partial x_j}$, and hence the optimum amounts of the x_j to use are independent of differences among the fixed variables (the Z_k) in the experimental and farm situation.

When the $\frac{\partial y}{\partial x_j}$ depend on the Z_k, he distinguishes two cases. *One* of these occurs when the substitution rates, $\frac{\partial x_i}{\partial x_j}$ are independent of the Z_k.

In the *other case*, they are dependent. He noted that when the $\frac{\partial x_i}{\partial x_j}$ are independent of the Z_k, optimum combinations of the x_i and x_j are not influenced by the differences between experimental and farm values of Z_k. The real difficulties, he points out, arise when neither the $\frac{\partial y}{\partial x_i}$ or the $\frac{\partial x_i}{\partial x_j}$ are independent of the Z_k.

In applying experimental results in farm situations where the Z_k have significantly different values than in the experimental situation, Swanson places heavy reliance on the "judgment of the experimenter," "farm observations," and experts such as agronomists. The use of judgment and of all available independent information in adjusting scientific results for application is always proper, advantageous and commendable, although sometimes criticized as unscientific in the sense of not being readily reproducible by other investigators. I think, however, that it must also be regarded as something of a makeshift to use until experimental designs are improved enough to reduce what appears to me to be an excessive need for adjusting experimental results on the basis of judgment and independent information. Swanson's procedure, like Heady's for selecting functions, needs more objectivity; the remedy appears to be more in the re-design of experiments rather than in adaptation of existing results.

Swanson excuses himself from discussing the problem of designing

experiments to eliminate differences in the Z_k between farm and experimental situations by asserting that he need not labor the point and by referring the reader, in a footnote, to the recent T.V.A. book entitled *Economic Analysis of Fertilizer Use Data* which he says discusses the problem at length. As that book, in fact, treats this subject quite inadequately, the profession would have benefited from a further discussion of this difficult problem.

In Swanson's functional formulation, e stands for unexplained deviations. At first, he assumes these deviations to be small enough to be ignored. Later, he relaxes this assumption and illustrates the application of game theory in finding a minimax solution to the problem of selecting the best of six possible uncertain strategies involving two varieties of corn and three fertilizer levels. His solution, unfortunately, assumes that the farmer's opposing player, *nature*, is cognitive and motivated to "do him in." Although my father and I felt this way about the old girl while farming in 1934 and 1936, I feel it would be better to regard her as a neutral who lets the rain fall on both the "just and the unjust." In general, Swanson's game application, as well as his earlier strategem of ignoring unexplained residuals, does not face up squarely to application problems that arise from unexplained residuals.

Unexplained residuals in experimental data may bear little or no resemblance to the unexplained residuals in a farm situation. Unexplained residuals in experimental data are themselves partial functions of uncontrolled and unstudied variables such as insects, disease, between-plot variations in soils, experimental errors, hail, weeds, past soil treatment, slope, etc. Also included among the causes of unexplained residuals are deviations of the experimental conditions, the Z_k, from the levels at which they are supposedly fixed. If the causes of unexplained residuals are relatively stable, independent of the X_j and have little influence on y, the unexplained residuals can be safely ignored. Even if the causes of the unexplained residuals fluctuate widely and have considerable impact on y, they can be "averaged out" provided their impact on y is random with respect to the X_j and provided there are enough observations. If, however, their impacts on y are not random with respect to the X_j, an estimate of the relationship between y and the X_j, given the experimental situation, will be biased. The problem of designing experiments to insure that unexplained residuals are reasonably random with respect to the X_j (we probably cannot hope for complete success) is a major one. This is also related to Heady's problem of selecting appropriate mathematical functions as, quite obviously, a function that does not "fit the data" has unexplained residuals that are partially functions of the X_j.

Swanson mentions both the Interstate Managerial Study and the more

specialized sociological studies on "how farm practices spread," the former in direct connection with the problem of unexplained residuals. When one looks at the managerial process, uncertainty or unexplained residuals become important. Uncertainty as the farmer, the *decision maker, sees it* is what counts.

Both the size of unexplained residuals in experimental data and the correspondence between the causes of unexplained residuals under experimental and farm conditions are crucial as farmers form their subjective estimates of the uncertainty involved in using experimental results. Large subjective uncertainties relative to the objective uncertainties involved slow up adoption of experimental results unduly. Biased estimates of yields and of partial derivatives mislead farmers. Similarly, inaccurate adoption results if subjective uncertainty is less than objective uncertainty. The problem is to help bring a farmer's estimates of expected yields and the derivatives of uncertainty into line with those he actually faces. Swanson emphasized the problem of adapting experimental yield and derivative estimates to farm conditions but neglected (1) the redesign of experiments to make adaptation of yield and derivative estimates less necessary and (2) both adaptation of results and the redesign of experiments to handle uncertainty.

Mason on Statistical Problems

Early in his paper, Mason drew a worthwhile distinction but in my opinion misnamed it. He designated work of the type under discussion today as "technical" as opposed to "scientific." Work of this nature might better be designated as "applied" as contrasted to "fundamental." Mason's terminology implies that work of this nature is unscientific, a charge I am sure he would not want to make or imply.

In general, Mason's paper faces up, rather admirably, to important design problems. I refer specifically to his discussion of defining and delimiting populations. In this connection his discussion of the causes of e, to use Swanson's terminology, is a desirable addition to Swanson's efforts. The North Carolina effort to sample two soil types in the eastern part of the state is a noteworthy attempt to overcome the limitations of using only one experimental field.

Mason's discussion of the choice of functional model emphasized (1) our lack of a priori information on appropriate forms, (2) that efficient design depends on the function to be fitted, (3) the value of simplicity in selecting functional forms, (4) the statistical significance of optima and (5) the problem of choosing the proper scale or transformation.

The last problem that Mason discusses is the problem of determining the economic amount of experimentation. Solving this problem involves

matching costs against returns. As such, it is more an economic than it is a statistical problem, a point I shall develop more fully later in this discussion.

A Recap of Areas Needing Discussion

Five problem areas, needing more discussion than offered in Heady's, Swanson's and Mason's papers, have been delimited. In a more convenient order for discussion purposes, they are:

1. The problem of selecting appropriate functions to fit on the basis of objective statistical tests.
2. The problem of designing experiments so that the fixed conditions in experimental situations correspond to/or are readily adaptable to those on farms.
3. The problem of designing experiments so that there is either a correspondence between the causes of unexplained residuals in experimental situations with those on farms/or a basis for translating experimental variances into estimates of "on farm variance."
4. The problem of designing experiments so that the causes of unexplained residuals have random impacts on experimental output which are distributed according to some convenient probability distribution.
5. The problem of the economic amount of experimentation (more broadly, research, including analysis of data) to carry out.

In what follows, time does not permit me to more than indicate, very briefly certain points that should be considered in connection with each of the five problem areas delimited above:

The problem of selecting appropriate functions on the basis of objective statistical tests is the most difficult of the five problems. Perhaps it is unsolvable in the general case. One of two functions, each involving at least one different term for the same independent variables and each meeting the preliminary requirements of economic and biological thought, will probably fail to meet the assumptions with regard to the distribution of residuals necessary for an objective statistical test if there is an important practical difference between the two functions. This suggests that objective tests for differences between functions tend to be useful mainly for demonstrating non-significant statistical differences between functions.

Perhaps a fruitful approach would be to test the degree to which the alternative functions individually meet the usual assumptions with respect to the distribution of unexplained residuals. If this were done, all functions failing to meet these assumptions could be rejected on an objective statistical basis *without the use of subjective judgment*. In some

cases, choices between those functions that meet the assumptions would still have to be made as some would differ from a practical standpoint. Where choices have to be made, one would be on firmer ground in using the objective tests after testing to see if the assumptions of those tests are met. Where such tests, in turn, would also fail to reveal statistically significant differences between the alternatives, as they often would, one would be forced to turn to the "experimenters' judgment," expert opinion and independent information as a basis for judgment. This procedure seems to have the advantage of first exhausting systematically the possibilities of objective tests and then using subjective criteria only if necessary.

The problem of designing experiments so that fixed conditions in experimental situations correspond to/or are readily adaptable to those on farms can be solved by going to work on it. The same effort can establish *greater correspondence between the causes of unexplained residuals in farm and experimental situations* and/or furnish a basis for translating experimental variances into estimates of "on farm variances." Too little effort has been devoted to solving these two problems. Instead, we have relied too heavily on applied researchers and/or extension men to make the adjustment.

Typically, it appears that most current studies control certain variables much more strictly than individual farmers can. Furthermore, it appears that these variables are often controlled at different levels experimentally than at which they are fixed on individual farms. Examples of such variables include: between field and between herd variations in disease and insect infestations as well as between-field variations in drainage. Typically only one field is used in a fertilization experiment, and then only a small one, many of which could be placed in the "fertilizing unit" of a commercial farmer. In feeding experiments, the experimental herd typically has only a few animals in it. Such small experiments make it possible to attain much higher degrees of uniformity than possible under farm conditions.

On the other hand, experimental controls with respect to those variables that vary from plot to plot and animal to animal are typically much looser than those that can be imposed by a farmer on *herd* or *field averages* when he is applying the results to a herd or field. Thus the correspondence is poor between experimental and farm situations with respect (1) to the levels at which unstudied variables are fixed, (2) to the fluctuations present among the causes of unexplained variance, and (3) to the average levels about which the causes of unexplained residuals fluctuate.

The general remedy, it appears, would involve (1) using more locations, larger plots or more replications (in the case argonomic experi-

ments) and small herds instead of individuals as the observational unit or more replications (in the case of animal experiments) and (2) treating as independent variables more of (a) the causes of variance which are troublesome at the farm level and (b) the variables which are commonly fixed on individual farms but at levels that vary from farm to farm.

The problem of designing experiments so that the causes of unexplained residuals have random impacts (with respect to the X_j) on experimental output and are distributed according to some convenient probability distribution has been discussed at length in design literature. About the only suggestion that I have to make is that the aid of farm management men be elicited in isolating the variables requiring randomization. The agronomist or animal husbandryman working in cooperation with a statistician finds it easy to overlook the necessity of randomizing such important variables as slope, weed infestation, managerial practices, etc. *over ranges appropriate for farm conditions.*

The problem of the economic amount of experimentation to carry out is an economic one. Diminishing marginal returns are ordinarily encountered with respect to both observation and analysis while, similarly, the value of information eventually increases at a decreasing rate. Under these conditions, the optimum amount of experimentation to carry out occurs when the marginal costs of information and the marginal value of information are equal.

The catch is that the value of information is not readily ascertainable in terms of objective measures such as dollars and cents. Nor would a researcher who has experienced the problems of producing accurate information argue that the costs of producing such information can be determined on a dollar and cents basis. Instead, the comparison needs to be made on a subjective, perhaps utilitarian, basis. Further, as most research is done on public account and/or by public spirited personnel and agencies, the problem of aggregating individual wants and preferences into social welfare functions arises. In the absence of consensus and interpersonally comparable utility measures, the aggregate value of information probably cannot be determined.[2] Thus, this discussant views Mason's discussion and his references to the works of Yates, Grundy, Heady and Rees with considerable pessimism. Objective measures or assumptions about objective measurability of gains likely will not produce meaningful answers. It appears that, for a long time, decisions as to the amount of experimentation worth doing will continue to have to be made on the basis of professional and administrative authority.

[2] K. J. Arrow, *Social Choice and Individual Values* (John Wiley and Son, Inc. New York), 1951.

THE SUPPORT PROGRAM AND THE STABILITY OF COTTON PRICES

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TO ASK whether government price support of agricultural commodi-
ties has resulted in more stable prices or not may seem trivial at
first sight because the immediate answer seems obvious. Of course agri-
cultural prices are now more stable than they were. It follows that
statistical evidence on this question should be clear cut. Unfortunately
this does not turn out to be the case. In this paper I shall explore some
of the difficulties that arose when I attempted to verify the "obvious."
My attempts were confined to cotton because it appeared to be the
easiest commodity to study from this point of view.

The Problem

To determine if prices are more or less stable than they would be in
the absence of a support program implies that we have available two
price series, the one with a support program and the other without.
Since a support program has been in effect for cotton since 1933, actual
prices from that date are affected by this factor. A price series for 1933
on, in the absence of a support program, is necessarily hypothetical. Sup-
pose however that we knew what prices would have been since 1933
in the absence of a support program, we would select criteria to de-
termine which of the two price series is the more stable. In some sense
price stability refers to the extent of price fluctuations, and these may be
measured by the range or standard deviation of prices. Because the
price of a particular commodity tends to vary with the general price
level, let us also agree at the beginning to use the deflated price in this
study.

What would have been the price of cotton since 1933 in the absence
of a support program? Knowledge of the very simple mechanism of the
program should help answer this question. Whenever the quantity of
cotton produced is so large that at the current support price, it exceeds
the quantity demanded, the difference between the quantity demanded
and the quantity produced is, in effect, sold to the government.[1] When-
ever, at the current support price, the quantity demanded exceeds the

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[1] In reality the government does not purchase the commodity from producers.
Instead, producers receive a loan from the government equal to the support price
per unit of the commodity multiplied by the number of units of the commodity used
as collateral for the loan. If the loan is not redeemed by a predetermined date then
the government takes title to the collateral in full settlement of the loan.

quantity produced then no cotton enters the government stockpile, all cotton is sold to private users, and the market price exceeds the support price. In principle the market price and the support price are identical when cotton is being sold to the government, although, as we shall see below, the price of cotton tends to exceed the support price even when the government is acquiring cotton.

Cotton owned by the government may be sold to private consumers under certain conditions which, roughly, amount to the restriction that the current market price exceeds the current support price by some minimal amount. Hence the support program supplies a mechanism for the government to acquire and dispose of stocks.

The acquisition and the disposal of stocks may or may not stabilize the price depending on the timing and appropriateness of the government's action. When prices are rising and the government sells, higher prices would have prevailed in the absence of government intervention. On the other hand, when prices are falling, and the government buys, prices would have been lower. In either event the market price is confined within a narrower range than had there been no support program. The government's action may also have de-stabilized prices if it increases the range of cotton prices. If when prices are falling, the government sells, then its action further increases the decline in prices. Conversely, if when prices are rising the government buys, its action further increases the rise. For under these conditions the government's action results in a lower price in the former case and a higher price in the latter case, contrary to what would have occurred in the absence of their intervention.

I have described the conditions under which the government can stabilize prices to show their similarity to the conditions under which speculation can result in more stable prices. Speculators who sell when prices are rising and buy when prices are falling by their actions damp down price movements and earn profits. Similarly when the government earns a profit on its support operations it too will have stabilized the price. Profits are earned when cotton is purchased at a lower price than it is sold. These conditions are equivalent to what I have just described.

However the government may succeed in stabilizing the price without profiting thereby. Suppose it announced that it would buy or sell unlimited amounts of cotton at a fixed price. Provided the government is willing to produce cotton when the fixed price is lower than the market price, it will surely succeed in stabilizing the price, though, perhaps, at a great cost.

Thus the financial results of the cotton support program would shed light on whether the government had or had not succeeded in stabilizing

the price. Such evidence, however, even if easily available, would be more powerful than required. A profitable support program implies price stabilization, but the converse need not hold since price stabilization need not imply a profitable support program.

Price Estimation

I shall estimate the price that would have prevailed in the absence of a support program and compare it with the actual price. Suppose the support program is in effect for all the years previous to the one considered and, given the actual quantity produced, either output exceeds demand at the current support price, in which case the government purchases the difference between the quantity produced and the quantity demanded, or the actual quantity produced is less than the quantity demanded at the support price, in which case the actual price exceeds the support price and the government may decide to sell some cotton from its previously acquired stocks.

The price that would have prevailed in the absence of the government's action may be found as follows: Suppose the quantity produced is less than the quantity demanded at the current support price. Let the actual price be p, actual consumption be q, the elasticity of the demand curve be e, and the quantity sold by the government be dq. The difference between the actual price and the price that would have prevailed in the absence of the government sale, dp, can be estimated from formula (1)

(1) $$dp = (p)(dq/q)(1/e),$$

which follows from the definition of the elasticity of demand. If the government sells nothing, dq is zero. That is, the difference between the actual price and the free market price, dp, is zero.

When the quantity demanded is less than the quantity produced at the support price, the government purchases the excess supply and prevents the price from falling below the support price. The difference between the free market price and the support price is given by

(2) $$dp = (p^*)(dq/q)(1/e)$$

where p^* is the support price. The support price less the free market price, dp, is negative because consumers could be induced to purchase the entire output at a price lower than the support price. Formulas (1) and (2) are used to estimate the free market price.

In the previous formulas the supply response of producers is neglected. Such a procedure is justified to estimate the short-run free market price when the elasticity of supply may be approximately zero, and the government sells stocks. In the long run when elasticity of supply is

not zero and the quantity produced exceeds the quantity demanded at the support price, formula (2) overstates the difference between the support price and the free market price that would exist in the long run.

The actual quantity purchased by the government, dq, may be divided into two parts designated dq' and dq''. The amount by which consumption would increase if the price fell from the support level to the free market price equating the quantity produced to the quantity demanded is dq', and dq'' is the decrease in production resulting from such a price decrease. Hence

$$(3) \qquad dq = dq' - dq''.$$

Let f be the elasticity of supply at the support price p*. Using the definition of the elasticity of supply formula (4) is derived.

$$(4) \qquad dq'' = (f)(dp/p^*)(q'')$$

where q'' is the quantity produced at the support price p*. Similarly, from the definition of the elasticity of demand, e, dq' is given by

$$(5) \qquad dq' = (e)(dp/p^*)(q')$$

where q' is the quantity actually consumed at the support price p*. At the support price p* the difference between the quantity produced q'' and the quantity demanded q' equals the quantity purchased by the government dq,

$$(6) \qquad dq = q'' - q'.$$

It follows from formulas (3) − (6) that dp, the difference between the long-run equilibrium price and the support price, can be written

$$(7) \qquad dp = (p^*)(dq)(1/eq' - fq'').$$

From formula (7) the long-run dp can be estimated.[2] Comparing formula (2) with formula (7) it is clear that dp is greater in absolute value in the short run than in the long run when the response of producers to a free market is allowed to take effect. It follows that the actual estimates of dp made overstates the long-run decrease from the support price to the free-market price when the quantity actually produced exceeds the quantity demanded at the support price.

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[2] If elasticities of supply and demand are defined at the free-market price p, and the free-market output q which equals the free-market demand when the price is p, the difference between the support price and the free-market price dp is given by

$$(8) \qquad dp = (p) \, (dq/q) \, (1/(e - f)).$$

This formula is not as useful as (7) because it requires knowledge of the free-market price and quantity. Formula (7) permits estimation of the free-market price in the disequilibrium position in which the government purchases stocks.

Bearing in mind these considerations my estimate of the free-market price is p + dp using formulas (1) and (2). Formula (2) strictly holds when the market price and the support price are identical and the government purchases cotton. When the government sells cotton, formula (1) is of course correct. However the actual price of cotton exceeds the support price by a small amount which decreases the greater the quantity of cotton purchased by the government. Hence instead of using p* for years in which the government purchases cotton, in the applications of the formula I shall use the actual price of cotton. It follows that p + dp estimates the price of cotton that would have been in the absence of a support program.

Empirical Results

It appears plausible that the elasticity of the demand for cotton lies between −0.5 and −1.0.[3] Using this range of elasticities the estimated

TABLE 1. STABILIZING EFFECT OF SUPPORT OPERATIONS ON COTTON PRICES*

Crop Year	P e = −0.5	P e = −0.7	P e = −1.0	Actual P
1933	15.79	16.09	16.31	16.83
34	6.83	9.63	11.73	16.61
1935	21.34	19.44	18.02	14.69
36	19.73	18.66	17.86	15.98
37	0.71	3.40	5.42	10.41
38	2.15	4.81	6.80	11.44
39	18.17	16.87	15.90	13.64
1940	19.26	17.96	16.98	14.69
41	23.34	22.94	22.65	21.95
42	25.52	24.29	23.38	21.24
43	15.94	17.28	18.30	20.66
44	22.80	22.48	22.25	21.70
1945	46.57	40.57	36.06	25.55
46	34.83	33.48	32.48	30.12
47	23.31	23.31	23.31	23.31
48	7.94	11.38	13.96	19.98
49	21.88	21.66	21.48	21.08
1950	39.72	36.08	33.35	26.98
51	19.74	19.90	20.03	20.31
52	13.26	14.69	15.78	18.31
53	3.57	7.72	10.83	18.10

* In cotton the crop year begins on August 1. Cotton prices are annual averages of Middling 15/16-inch cotton at New York deflated by the Dept. of Commerce wholesale price index (1926 = 100). The elasticity of the excess demand curve is e and the first three columns refer to the estimated free-market prices derived for various values of e using formula (1).

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[3] This range of values is derived from estimates of the demand for cotton to be found in Table 3.

free-market prices together with the actual deflated price are presented in Table 1. Three estimates of p + dp are presented for e equal −0.5, −0.7, and −1.0. The smaller in absolute value is e, the greater is the difference between the actual price and the estimated free-market price.

The range of actual deflated prices is 20 cents per pound. The range for the estimated deflated free-market price is about 31 cents per pound for e equal to −1.0, 37 cents per pound for e equal to −0.7, and 45 cents per pound for e equal to −0.5. Fluctuations in the actual deflated price of cotton are less than for the estimated deflated free-market prices. Hence the government appears to have succeeded in stabilizing the price of cotton.

There are at least two sources of bias in my estimates of the free-market price in addition to the one already discussed above.[4] First, the actual price does not equal the support price when the quantity produced exceeds the quantity demanded at the support price. Second, I have assumed that the supply and demand schedules for cotton have not shifted as a result of the support program. These two points will be further explained.

I have stated already that the actual price of cotton tends to exceed the support price even when the government is purchasing cotton. In the first column of Table 2 is the deflated difference between the annual average price of Middling 15/16-inch cotton at New York and the national average support price for that grade. In the third column is the change in government stocks from the beginning to the end of the crop year. When government stocks increase ΔG is positive, and the annual average price of cotton at New York exceeds the support price by 1.43 cents per pound. Two explanations may be offered. First, the price at New York tends to exceed the national average price by the cost of transporting cotton from producing areas to New York, although in recent years such shipments have not been very important. Second, although Middling 15/16-inch cotton is the most important, not all the cotton is of this kind. However, the greater the quantity of all cotton acquired by the government, the more is made up of this kind and the smaller is the difference between the support price and the actual price at New York. This become evident from a comparison of ΔG to (P − L)/W in Table 2. Since a weighted national average support price for cotton is not available, I use the actual price at New York to estimate the support price for those years in which the government purchased cotton. It follows that, the New York price being an upward biased

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[4] A biased estimate of the free-market price, however, need not imply a biased estimate of the range of fluctuation of the free-market price, e.g., the bias may be a constant.

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TABLE 2. DATA RELATED TO COTTON PRICE SUPPORT PROGRAM

Crop Year	$(P_t-L_t)/W_t$*	$\Delta G_t/G_t$ ($\Delta G_t<0$)	ΔG_t	G_t on August 1 (million bales)
1933	1.65		0.410	2.627
34	.60		2.990	3.037
1935	2.10	0.463	−2.790	6.027
36	2.36**	0.485	−1.572	3.237
37	−.29		5.281	1.665
38	.50		4.103	6.946
39	2.04	.210	−2.316	11.049
1940	3.05	.193	−1.686	8.733
41	6.80	.055	.390	7.047
42	3.82	.190	−1.267	6.657
43	1.98		1.267	5.390
44	1.43	.044	− .293	6.657
1945	5.61	.825	−5.249	6.364
46	9.99	.951	−1.061	1.115
47	4.94	.130	− .007	.054
48	1.36		3.778	.041
49	2.10	.073	− .279	3.819
1950	8.74	.978	−3.461	3.540
51	4.40		.206	.079
52	1.77		1.733	.285
53	0.92		5.007	2.018
54				7.025

* Average $(P_t-L_t)/W_t$ is 3.14.
  Average $(P_t-L_t)/W_t$ when $\Delta G_t>0$ is 1.43.
  Average $(P_t-L_t)/W_t$ when $\Delta G_t<0$ is 4.42.
** There was no loan program in effect for 1936. We assume that the program in effect was equivalent to a support price of 11¢ per pound.
  P_t is the annual average price of Middling 15/16-inch cotton at New York in cents per pound.
  L_t is the national support price for Middling 15/16-inch cotton in cents per pound.
  W_t is the Dept. of Commerce wholesale price index (1926 100).
  G_t is total government stocks which equals loans outstanding plus owned inventories in millions of bales.

estimate of the weighted average support price, the free-market price estimated also has an upward bias.

The second source of bias in the estimated free-market price is conjectural. Assume that producing cotton is not as risky a business under the support program as in its absence. If farmers prefer less risky to more risky businesses then somewhat more cotton is produced at a support price that equals the expected price of cotton in the absence of a support program. It follows that the support program may have shifted the supply schedule of cotton to the right for domestic and foreign cotton producers. This being the case the demand for U. S. cotton abroad may have also decreased. Hence we underestimate the free market price of cotton because the actual quantity of cotton produced at each

price is greater and the actual demand for U. S. cotton is less as a result of the support program.

Additional evidence of the price-stabilizing effect of the support program can be found by relating the price of cotton to the same variables during the period of support operations as in the previous period of the free market. During the free-market period at the time of harvest the price of cotton in the United States is determined by the world supply of American cotton, the total supply of foreign cotton, national income in the United States, income in the rest of the world, and other variables. The regressions in Table 3 indicate how well the price of American cotton can be explained by foreign and American supplies of cotton at the beginning of the crop year and United States national income (reliable estimates of income in the rest of the world are not available). These regressions may be interpreted to be the world demand for cotton given total supplies. The price of cotton may be expected to be lower the greater are the supplies of foreign and American cotton, and to be higher the higher is American national income.

Given the mechanism of the support program, how well should these variables explain the price of cotton after 1933? Consider the extreme case in which the government announces a fixed support price for the entire period and is willing to buy or sell unlimited amounts of cotton at this price. In such an extreme case the correlation between the price of cotton and total supplies would be zero. Hence a regression estimated

TABLE 3. FACTORS DETERMINING THE ANNUAL AVERAGE PRICE OF COTTON (MIDDLING 15/16-INCH) AT NEW YORK[a]

	R_t	P_t^d	S_t	X_t	I_t	W_t	Constant	S	R^2	e	N	δ^2/s^2
(1)[b]	1		−1.393 (.422)	− .632 (1.135)	1.608 (2.581)		48.234	3.926	.742	− .67	13	1.05
(2)[c]	1		− .495 (.247)	− .924 (.202)	1.333 (.305)		40.485	2.442	.758	−1.64	16	1.61
(3)[b]		1	−1.220 (.272)	−2.763 (.926)	5.223 (1.924)	−.0631 (.0489)	65.405	2.513	.918	− .75	13	1.82
(4)[c]		1	− .993 (.288)	−1.173 (.301)	3.758 (.898)	.0321 (.0564)	39.300	2.500	.973	−1.05	16	1.35

[a] P_t=Annual average price of Middling 15/16-inch cotton at New York in cents per pound. W_t=Dept. of Commerce wholesale price index (1926=100). R_t=P_t/W_t. S_t=World supply of American cotton in millions of bales. X_t=World supply of foreign (non-American) cotton in millions of bales. I_t=Index of deflated U. S. national income (1947–'49=100). Deflator in the consumers' price index 1947–'49=100. The members in the first seven columns are the regression coefficients with their standard errors in parentheses. The elasticity of demand is e. The standard error of an estimate is S. R^2 is the correlation coefficient squared. N is the number of observations, δ^2/s^2 is the Von Neumann ratio.

[b] The period covered in these regressions is 1920–32.

[c] The period covered in these regressions is 1933–'47, 1947–'53. The war years are omitted because price controls were in effect.

[d] In regressions (1) and (2), the dependent variable is the annual average price of Middling 15/16-inch cotton at New York deflated by the U. S. wholesale price index (1926=100). In regressions (3) and (4) the dependent variable is not deflated, and the wholesale price index has been entered as a separate independent variable. That spurious correlation does not result can be seen by comparing the coefficient of the wholesale price index to its standard error.

TABLE 4. DATA FOR REGRESSIONS IN TABLES 3 AND 4*

Year	R_t	P_t	W_t	S_t	I_t	X_t
1920	11.59	17.89	154.4	20.00	4.04	12.38
21	19.38	18.92	97.6	17.96	3.36	12.38
22	27.14	26.24	96.7	15.80	4.13	13.14
23	30.92	31.11	100.6	13.65	4.75	13.01
24	25.22	24.74	98.1	16.72	4.71	14.00
1925	19.84	20.53	103.5	19.56	4.89	15.13
26	15.15	15.15	100.0	23.66	5.05	14.74
27	21.40	20.42	95.4	20.80	5.09	15.20
28	20.40	19.73	96.7	19.76	5.35	16.58
29	17.42	16.60	95.3	19.23	•5.66	17.56
1930	12.01	10.38	86.4	20.06	5.01	17.21
31	8.68	6.34	73.0	25.85	4.34	15.43
32	11.37	7.37	64.8	26.22	3.44	18.66
33	16.83	11.09	65.9	24.52	3.44	20.30
34	16.61	12.44	74.9	20.28	4.04	21.68
1935	14.69	11.75	80.0	19.54	4.60	25.00
36	15.98	12.91	80.8	19.37	5.18	25.79
37	10.14	8.75	86.3	24.65	5.67	24.76
38	11.44	8.99	78.6	25.45	5.29	23.41
39	13.64	10.52	77.1	25.56	5.79	24.12
1940	14.69	11.55	78.6	24.86	6.44	24.36
41	21.95	19.16	87.3	23.42	7.87	24.36
42	21.24	20.99	98.8	23.70	9.34	24.47
43	20.66	21.30	103.1	22.36	10.88	25.74
44	21.70	22.57	104.0	23.24	11.48	25.80
1945	25.55	27.03	105.8	21.90	11.13	26.20
46	30.12	36.48	121.1	19.10	10.17	25.70
47	23.31	35.45	152.1	17.40	9.76	24.70
48	19.98	32.98	165.1	19.20	10.18	23.00
49	21.08	32.68	155.0	23.30	10.03	21.40
1950	26.98	43.57	161.5	18.60	11.03	24.90
51	20.31	40.48	199.3	18.70	11.79	27.40
52	18.31	35.38	193.2	19.80	12.11	29.70
53	18.10	34.46	190.4	23.10	12.60	29.80

* The variables are defined in Table 3. Data are taken from U. S. Dept. of Agriculture, Agricultural Marketing Service, *Statistics on Cotton and Related Data* (Washington, D. C.: U. S. Government Printing Office, June, 1951) Statistical Bulletin No. 99. See also the Supplement issued in September, 1954.

for the period after 1933 using the same variables to explain the price of cotton as a regression for before 1933 would not explain the price of cotton at all. However, it is evident that such a regression explains the price of cotton quite well in Table 3. Regressions (1) and (3) in Table 3 use data for the period 1920-1932, the longest period before the government support operations for which data are available. Regressions (2) and (4) in Table 3 refer to the period 1933-1941, 1947-1953, the period of government price support operations. The correlations for corresponding

TABLE 5. RESIDUALS FOR REGRESSIONS IN TABLE 3

Year	(1)	(2)	(3)	(4)
1920	7.45		0.26	
21	1.41		1.75	
22	−2.58		− .95	
23	−2.29		.15	
24	−1.56		− .01	
1925	− .31		−1.79	
26	−1.07		.72	
27	−3.57		−1.83	
28	−1.57		−2.41	
29	2.02		.37	
1930	5.45		3.71	
31	.77		2.95	
32	−3.97		−3.10	
33		−1.13		−2.97
34		.47		.51
1935		2.23		2.59
36		−1.27		− .09
37		1.88		− .08
38		.63		−1.59
39		.29		.19
1940		− .21		1.51
41		−5.07		.70
1947		−1.24		− .82
48		3.33		3.85
49		1.48		1.07
1950		−4.00		−5.29
51		1.32		−1.16
52		1.07		1.15
53		.22		.43

Residuals are defined to be the computed values minus the actual values. Numbers in the column headings refer to the corresponding regressions in Table 3.

regressions in Table 3 are not very different in the two periods, and if anything they are higher in the support period.

In the extreme case discussed above the demand for American cotton is perfectly elastic. In the regressions in Table 3 it is clearly indicated that the demand for cotton is more elastic under the support program than before. The support program has reduced the effect on price of fluctuations in the supply of foreign and American cotton. The coefficient of S_t is reduced in all of the regressions for the period of support operations compared to the earlier period (1920-1932). The regressions indicate that the government has entered the market and has affected the price of cotton in approximately the same way as would an additional group of cotton traders. The total supply of cotton, whether publicly or privately

held, and other variables determine the price of cotton. If the government profits by its support operations then it will have aided in stabilizing the price of cotton in the same way that a private group of speculators entering the cotton market would aid in stabilizing cotton prices by engaging in profitable speculation. Thus to corroborate the results of the regressions it is important to know the financial results of the cotton support program. Through 1953 the cotton program resulted in a net gain to the government of $274 million.[5]

Conclusion

The evidence, crude as it is, leads to the conclusion that the support program has resulted in more stable cotton prices. The major difficulty in answering a question of this sort is that what actually happened is being compared to what did not in fact happen. We shall never know what prices would have been in the absence of a support program from 1933 to 1953. Comparing actual prices to plausible estimates of "free-market" prices indicates that cotton prices were stabilized. The more indirect test provided by the regressions and the financial results of the program lends further support to this conclusion. The most fruitful source of further inquiry rests on the somewhat novel hypothesis that prices are stabilized to the extent that the government operates on the market in the same way as speculators who engage in profitable transactions.

Investigating the gains and losses attributable to the support program is a most fruitful source of further inquiry. Such an investigation has already been undertaken by the United States Department of Agriculture.[6] The loss in the corn support program amounted to $255 million through 1955, and the realized loss on wheat amounted to $374 million for the same period. Such a loss does not necessarily imply lack of price stabilization for these two programs, and it is desirable that a similar analysis be undertaken for these and other supported commodities as was undertaken for cotton.

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[5] U.S. Dept. of Agriculture, Commodity Stabilization Service, *Report of Financial Condition and Operations as of April 30, 1955.*

[6] U.S. Dept. of Agriculture, Agricultural Research Service, *Governmental Cost in Agriculture: The Concept and its Measurement* (Washington: U.S. Dept. of Agriculture, May, 1956).

A MODIFIED SIMPLEX SOLUTION FOR LINEAR PROGRAMMING WITH VARIABLE PRICES*

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THERE are many programming problems where the investigator is interested in the optimum plans for different price situations.[2] Interest may center on price changes compatible with a given program remaining optimum, on the effect of altered support prices on farm income and optimum production plans, or on the nature of a farm or region's normative supply function. These problems could be tackled by deriving a series of optimum programs, one for each price situation of interest. This, however, would be extremely laborious. The purpose of this article is to illustrate more efficient "variable-price programming" methods. We discuss both one-price and two-price-variable programming. Methods become more complicated as the number of prices to be varied increases. However, the principles remain the same, and the reader should have little difficulty in extending our results to three or more prices if required.

Principles

There are two important steps in our method of variable-price programming. The first is to state the problem being tackled in a way that is amenable to variable-price programming; the second is to derive a plan for a relevant price situation, then ask, "what price change is necessary to make another plan optimum?"[3] To be more specific let us consider a

[2] The possibility of variable-price programming has been mentioned by A. Charnes, W. W. Cooper and A. Henderson, *An Introduction to Linear Programming*, John Wiley and Sons, Inc., New York, 1953; by R. Dorfman, "Mathematical, or 'Linear' Programming: A Nonmathematical Exposition," *American Economic Review*, Vol. 43, Dec., 1953, p. 823. I believe that H. W. Kuhn and A. W. Tucker in "Nonlinear Programming," *Second Berkeley Symposium on Mathematical Statistics and Probability*, Berkeley: University of California Press, 1950, have solved the problem of variable-price programming in principle. C. Hildreth, "Economic Implications of Some Cotton Fertilizer Experiments," *Econometrica*, Vol. 23 (1955), p. 88; and W. D. Fisher and L. W. Schruben, "Linear Programming Applied to Feed Mixing Under Different Price Conditions," *Journal of Farm Economics*, Vol. 35 (1953) p. 471, have presented price maps for certain simple problems. The present paper may be considered a generalization of methods presented in the two latter papers.

[3] Common sense tells us that at different prices different plans may be optimum (i.e., may give the highest income). At low hog prices, a plan with little or no hog production is likely to be optimum, while at a higher price the farmer may be well

TABLE I. INPUT-OUTPUT COEFFICIENT FOR EXAMPLE OF VARIABLE-PRICE PROGRAMMING

Item	Activities					
	Corn A (P₁)	Corn B (P₂)	Hogs A (P₃)	Hogs B (P₄)	Dairy (P₅)	Hog selling (P₆)
Units	Acre	Acre	Fall litters	Fall litters	Cow	Litter
Inputs:						
Capital ($)	200	395	1,000	1,050	30	0
Labor (hrs.)	10	20	20	15	20	1
Corn (bu.)	0	0	10	25	10	0
Hogs (litters)	0	0	0	0	0	1
Outputs:						
Corn (bu.)	10	21	0	0	0	0
Hogs (litters)	0	0	1	2	0	0
Net revenue ($P_k=0$)($)	−10	−23	−80	−170	40	0
Net revenue ($P_k=1.20$)($)	2	2.2	−92	−200	28	0

problem where we are interested in the effect of changing hog prices. The first step is to construct a simple matrix with the assumption of zero hog price. That is, the hog activities are given no financial credit for hogs produced. We include, however, a "hog row," in which hog production is recorded in physical, or real, terms. If the units in the hog row are litters, then an activity producing one litter of hogs will have a minus one in the hog row; an activity producing two litters will have a minus two, and so on. Finally, we include a hog-selling activity.[4] This activity is credited with the minimum price for hogs that is of interest. At this stage the problem is in a form "amenable to variable-price programming."[5] The second step is to derive the optimum program in the usual

advised to expand his hog enterprise. (We will see later that, in the linear programming model, this expansion takes place by discrete jumps.) If two different plans, A and B, are optimum at different prices of hogs (say A at a low and B at a high price) then there will be some intermediate price at which A and B *give the same income*. This price may be described as defining the "border" between plans A and B. At a lower price plan A gives a higher income than (or is preferable to) plan B, while at a higher price B is preferable to A. At the border plans A and B result in the same income. Clearly the border price is of great interest, since if we know it we can tell *for any other price* if plan A or plan B is preferable. If we first start with a low price (and plan A is optimum) we can refer to the border price as the price at which A ceases to be optimum (becomes suboptimum) or B becomes optimum (ceases to be suboptimum). If we say that "the optimum plan is a plan such that no other feasible plan has a higher income," both plans are optimum at the border price. If we say "the optimum plan has a higher income than any other feasible plan" neither plan is optimum at the border price!

[4] If "hog selling" has one unit in the "hog row" as its only input, then "hog selling" can be used as the disposal activity for hogs. If, on the other hand, as in our example, one or more of the other scarce resources is used in selling hogs, the hog-selling and hog-disposal activities must be separated.

[5] When a problem has been stated in this form, readers who are used to using

TABLE 2. AN EXAMPLE OF ONE-PRICE-VARIABLE PROGRAMMING

TABLE 2. AN EXAMPLE OF ONE-PRICE-VARIABLE PROGRAMMING*

$c_j \rightarrow$	Section	R	\\ Real activities						\\ Disposal activities				Resource or product supply P_0	Basis row
			Hog sell P_6 (0)	Dairy P_5 (28)	Hogs B P_4 (−200)	Hogs A P_3 (−92)	Corn B P_2 (2.2)	Corn A P_1	Corn P_{10} (0)	Hogs P_9 (0)	Labor P_8 (0)	Capital P_7 (0)		
Capital	1.		0	30	1,050	1,000	395	200	0	0	0	1	5,000	P_7
Labor			1	20	15	−1	20	10	0	0	1	0	200	P_8
Hogs			−1	0	−2	10	0	0	0	1	0	0	0	P_{10}
Corn			0	10	25	92	−21	−10	1	0	0	0	0	z_j-c_j
2 ↓ 28			0	−28	**200**	**92**	−2.2	−2						Plan 1
2, A'		—	−7.667	0	1,243.336	970.000	−17.334	0	12.334	0	−7.667	1	3,466.662	P_7
↓2 ↑28		202	0.033	0	−1.167	−1.000	2.067	1	−0.067	0	0.033	0	6.667	P_1
		202	**1.000**	0	−2.000	1.000	0	0	0.033	1	0.033	0	0	P_9
Plan 1			0.033	1	1.333	120.000	−0.033	0	0.800	0	**1.000**	0	6.667	P_6
z_j-c_j			**1.000**	0	**235.000**		**1.000**		0.800		**1.000**		200.001	
3, B'		2.82	0	0	1,228.001	962.334	−17.334	0	12.334	7.667	−7.667	1	3,466.662	P_7
↓2 ↑28			0	0	−1.100	0.033	2.067	1	−0.067	−0.033	0.033	0	6.667	P_1
		4.76	1	0	−2.000	−1.000	0	0	0.033	1	0.033	0	6.667	P_6
Plan 2 ΔP_h			0	1	1.400	1.033	−0.033	0	0.800	−0.033	**1.000**	0	200.001	P_9
z_j-c_j			•	0	**235.000**	120.000	**1.000**	0	0.800	**1.000**	**1.000**	•	200.001	
			0	0	117.500	2.500	**1.000**			118.500				
4, C'			0	0	1	0.784	−.014	0	0.010	0.006	−.006	0.001	2.823	P_2
↑−200 ←2 118.5 28		4.76	0	0	0	0.805	2.051	1	−.056	−.026	0.026	0.001	9.772	P_1
			1	0	0	0.567	−.028	0	0.020	1.012	−.012	0.002	5.646	P_6
Plan 2 ΔP_h			0	1	0	−.064	−.014	0	0.019	−.042	0.042	−.001	2.714	P_9
z_j-c_j			•	•	•	2.500	**1.000**	•	0.800	118.500	**1.000**	•	200.001	
			0	0	0	22.592	**35.415**		1.511	153.357	**80.193**	0.057	399.954	
											46.046			
5, D'			0	0	1	0.437	0.790	0.007	0.010	0.006	−.006	0.001	2.890	P_2
↑−200 2.2 153.915 ←28		360.03	0	0	0	0.580	1	0.488	−.027	−.013	0.013	0.002	4.764	P_1
		65.78	1	0	0	−.058	0	0.014	0.019	1.012	−.012	−.001	5.781	P_6
Plan 3 ΔP_h			0	1	0	22.592	0	0.007	0.019	−.042	0.042	0.057	2.779	P_9
z_j-c_j			•	•	•		•		1.511	153.357	0.558		399.954	
6, E'			0	0.143	1	0.782	0	0.008	0.012	0	0	0.001	3.289	P_2
−200 2.2 199.961 0			0	−0.306	0	0.454	1	0.486	−.033	1.000	0	0.001	3.915	P_1
			1	0.287	0	0.563	0	0.016	0.024	−1.000	0	−.026	6.578	P_6
Plan 4			0	23.669	0	−1.370	0	0.157	0.447	199.961	1	0.132	65.778	P_5
z_j-c_j			0	0	0	49.292	0	0.634	2.400				666.127	

* The figures in this table have been rounded to three decimal places from five. It is believed that the reader will be able to establish which ratios are being computed.

way, and then to compute the minimum positive change in the price of hogs, $\Delta P_{h\ min}$, that will make one of the positive z_j-c_j coefficients zero. The alterations appropriate to this price change are made (i.e., the z_j-c_j coefficients are altered), and when the activity with a zero z_j-c_j has been included in the program, we again ask "what is the minimum price change, $\Delta P_{h\ min}$, necessary to make another plan optimum?" When the price of hogs has been raised to the maximum value of interest, or alternatively, maximum hog output has been attained from the physical resources available, the one-price variable programming solution has been completed.

Example of One-Price-Variable Programming

Table 1 summarizes the input-output coefficients and net revenues for a linear programming problem that could have occurred in the Midwest. One dairy, two corn and two hog-producing activities are to be considered. The farmer is assumed to have $5,000 of capital and 200 hours of labor. The bottom line gives the net revenues or c_j's for the activities. The penultimate line will be used for the example of two-price-variable programming.[6]

In the present problem we assume corn price at $1.20 per bushel and we are interested in optimum farm plans as the price of hogs varies from zero to an infinite price per litter. From Table 1 we obtain Section 1 of Table 2. Section 2 of Table 2 is the optimum plan for zero hog price ($P_h = 0$).[7] This plan is referred to as Plan 1. Since the z_j-c_j for hog selling in Section 2 is $1.00, it follows that unless the hog price (the c_j for hog selling) rises to $1.00 per litter, the z_j-c_j for hog selling will remain positive (and Plan 1 will be optimum). Thus Section 2 will continue to represent the optimum plan unless the price of hogs rises to $1.00 per litter.[8]

"the dual" to solve linear programming problems will recognize that use of the dual and a suitable modification of my method of "continuous programming" would be one way of doing "variable-price programming." Indeed this was the guise in which variable-price programming first occurred to me. I have felt justified in presenting the present method since it avoids the necessity for mastering "the dual," and permits us to tackle our programming problems with a minimum number of rows. See: W. Candler, "A Modified Simplex Solution for Linear Programming with Variable Capital Restrictions," *Journal of Farm Economics*, Vol. 38, Nov. 1956.

[6] Note that "hog selling" requires one hour of labor and hence requires a larger outlay of scarce resources than the formal "disposal" of hogs.

[7] Section 2 of Table 2 is obtained from Section 1 in the conventional manner ("the most negative z_j-c_j indicates the activity to be introduced . . ." etc.,) but the sections that should come between 1 and 2 (where P_1 and P_5 replace P_8 and P_{10}) have been omitted to save space.

[8] Actually, hog price would have to be *more than* $1.00 per litter for z_6-c_6 to become negative. However, at $1.00 $z_6 - c_6 = 0$, and hence $1.00 is the critical "border price." At a price less than $1.00 Section 2 is optimum; at a price greater than $1.00 Section 3 is optimum. At $1.00 the sections are equally desirable.

At a price of \$1.00 per litter $z_6\text{-}c_6 = 0$, and P_6 (hog selling) *can be introduced into the plan without affecting the $z_j\text{-}c_j$'s* of the other activities. The logical interpretation of the step from Section 2 o 3 is that in Section 2 with a hog price of zero ($P_h = 0$) *hog selling* will reduce income. This potential loss of revenue is represented by the positive $z_j\text{-}c_j$ for hog selling. On the other hand, with $z_6\text{-}c_6 < 0$, hog selling should be introduced, since the $z_j\text{-}c_j$ indicates that, unless it is included in the plan, income may be sacrificed. The hog price which will make $z_6\text{-}c_6 = 0$ is the "border price" for hogs between Sections 2 and 3. At a lower hog price Section 2 is optimum, at a higher hog price Section 3 is optimum and at $P_h = \$1.00$ (the border hog price) Sections 2 and 3 yield the same income.

The plans of Sections 2 and 3 are the same in real terms (\$3,467 of capital in disposal with production of 6.7 acres of corn A and 6.7 dairy cows); hence, they are both designated "Plan 1." In Section 2 the plan includes zero amount of the hog-disposal activity; in Section 3 we replace this with zero amount of the hog-selling activity. This tells us that hogs should be sold rather than allocated to "disposal" when price is \$1.00 or more.

We now consider the effect of a change in hog price on the marginal revenues, $z_j\text{-}c_j$'s, of Section 3. It is well known that:

$$z_j\text{-}c_j = \sum_i c_i a_{ij} - c_j \qquad (1)$$

where the a_{ij}'s are the input coefficients of the j-th column, the c_i's are the associated prices of the resources or products, and c_j is the price per unit of the j-th activity. Letting h_j be the hog coefficient of the j-th column, and P_h be the price of hogs, we can rewrite (1) as:

$$z_j\text{-}c_j = P_h \cdot h_j + \sum_i c_i a_{ij} - c_j \qquad (2)$$

where the summation over i includes all rows other than the hog row.

If we let ΔP_h stand for a change in hog price, and $z_j\text{-}c_j{}^*$ stand for the resulting new marginal revenue, we can write:

$$z_j\text{-}c_j{}^* = (P_h + \Delta P_h) \cdot h_j + \sum_i c_i a_{ij} - c_j \qquad (3)$$

or, substituting from (2)

$$z_j\text{-}c_j{}^* = \Delta P_h \cdot h_j + z_j\text{-}c_j \qquad (4)$$

Consequently, the new marginal revenue for the j-th activity ($z_j\text{-}c_j{}^*$) associated with a changed hog price is equal to the old marginal revenue plus the product of the change in hog price and the j-th activity's hog input coefficient. By "the j-th activity's hog input coefficient" we mean the coefficient in the j-th activity's hog-selling row. Thus if hog selling is

not in the plan we raise hog price until we reach the border value at which it comes in. Once hog selling *is* in the plan we use the coefficient in the hog-selling row to get the next border value for hog price.

Also we may note that unless one of the activity's new marginal revenue, z_j-c_j* becomes zero or negative, Section 3 will remain optimum. Symbolically, unless $z_j c_j$* ≤ 0 for some activity, Section 3 remains optimum. Adding this condition to (4) we get:

$$\Delta P_h \cdot h_j + z_j\text{-}c_j = z_j\text{-}c_j{}^* \leq 0 \qquad (5)$$

and solving

$$\Delta P_h \geq \frac{z_j\text{-}c_j}{-h_j} \qquad (6)$$

Thus equation (6) must hold for at least one activity before another plan becomes optimum. The change in hog price must be greater than or equal to z_j-$c_j/-h_j$ before the j-th activity will have a zero or negative z_j-c_j*. So long as we are only considering the effect of a price rise, the change in price, ΔP_h, must be positive $\Delta P_h > 0.z_j$-c_j must also be positive, z_j-$c_j > 0$, or the original plan would not be optimum for the old hog price, P_h. It follows that for equation (6) to hold, the hog coefficient, h_j, must be negative, $h_j < 0$. This corresponds to the common-sense argument that only activities that *increase* the supply of hogs will come into the optimum program as we *increase* the price of hogs (all other prices remaining fixed). The reader will recall that where an activity has a negative hog input coefficient introduction of the activity will *increase* the supply of hogs. From (6) we see that if the hog-input coefficient is zero, an infinitely large price of hogs will fail to give a negative z_j-c_j. Again, this follows a common-sense argument.

If we compute the ratio in (6) for all activities with $h_j < 0$, we get a series of changes in the hog price sufficient to alter the optimum program. Clearly we will be interested in the minimum change, ΔP_h min. The ΔP_h line of Section 3 (Table 2) corresponds to equation (6) for the activities (P_3 and P_4) which have $h_j < 0$. Since 117.500 is the minimum entry in this row, a rise in hog price of \$117.50 per litter is required before another plan becomes optimum. If hog price is raised by \$117.50, total hog price becomes \$118.50 (or \$1.00 + \$117.50). Line z_j-c_j* of Section 3 gives the z_j-c_j's values when hog price has been increased by \$117.50 per litter. These entries represent merely the old z_j-c_j plus 117.50 × the hog-input coefficients. Thus

$$z_3\text{-}c_3{}^* = z_3 - c_3 + \Delta P_h \cdot h_3$$
$$= 120.00 + 117.50 \times - 1.00$$
$$= 2.50$$

z_4-$c_4^* = 0$,[9] and if P_4 is introduced to give Section 4 (Plan 2), while hog price remains at \$118.50, *there will be no further alteration in the z_j-c_j coefficients*, i.e., the z_j-c_j coefficients of Section 4 correspond to the z_j-c_j^* coefficients of Section 3. The usual rules apply for the derivation of the new input-output coefficients as P_4 replaces P_7, to give Plan 2.

In Section 4 we once again compute the ΔP_h ratio, find the minimum value (35.415), and add the product of this minimum value times the hog-input coefficient to the old z_j-c_j's to get the z_j-c_j^*'s. We note that z_2-$c_2^* = 0$; therefore, the z_j-c_j^*'s of Section 4 are the z_j-c_j's of Section 5. The input-output coefficients are computed in the usual way, as P_2 replaces P_1 to give Plan 3. In Section 5 the ΔP_h ratio has again been computed; however, the z_j-c_j^*'s of Section 5 have been recorded directly as the z_j-c_j's of Section 6. Introdution of P_8 gives Plan 4 which is the optimum plan for \$199.961 per litter of hogs. Since there are no negatives in the hog-selling row of Plan 4, there is no possibility of further increases in hog production, Plan 4 is optimum for \$199.961 hogs *and all higher hog prices.* Maximum hog output, subject to the restrictions of the problem, has been achieved.

Thus, if "hogs" are taken to represent any product for which the price is to be varied, the rules for one-price-variable programming may be stated:

1. Formulate the problem so that individual activities are credited with "hog" production in *real or physical terms only*, but include a selling activity with the minimum hog price of interest.

2. Find the optimum program for the problem specified in 1.

3. If hog selling is not in the plan, introduce hog selling by raising its price by the value of its z_j-c_j. (All z_j-c_j's except hog selling are unaffected by this step.)

4. Calculate the ΔP_h ratio. Divide z_j-c_j by h_j where h_j, the hog-selling input coefficient, is negative, and z_j-c_j has its usual meaning. Record ΔP_h in the ΔP_h row as its absolute value, i.e., as a positive number.

5. The smallest entry in the ΔP_h row specifies the activity to be introduced. The input coefficients of the next section are computed in the usual way but the new z_j-c_j's are the old z_j-c_j's plus the minimum ΔP_h times the appropriate hog-selling input coefficient of the old section. (Add ΔP_h to P_h to get the new hog price.)

6. Repeat steps 4 and 5 until hog price has reached the maximum value of interest; or until there are no more negatives in the hog-selling row.

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[9] It may be objected that z_4-c_4^* of Section 3 is not the only z_j-c_j^* coefficient which is zero. The z_j-c_j^*'s of P_1, P_5, P_6 and P_7 are also zero. However, P_1, P_5, P_6 and P_7 are *already in the plan;* P_4 is the only activity, *not in the plan*, with a z_j-c_j^* of zero.

The ΔP_h ratio is, of course, computed for the disposal activities in the same way as for production processes. If the smallest ΔP_h is in a disposal column; the disposal activity is introduced in a manner homologous with the introduction of a production process. In short, for computation no distinction is drawn between production and disposal activities.

Table 3 summarizes the plans obtained from Table 2, the range of hog prices over which the plans are optimum, and the plans' income for zero hog price. This information is also summarized in Fig. 1. Fig. 1A summarizes how income changes as the price of hogs increases. The heavy
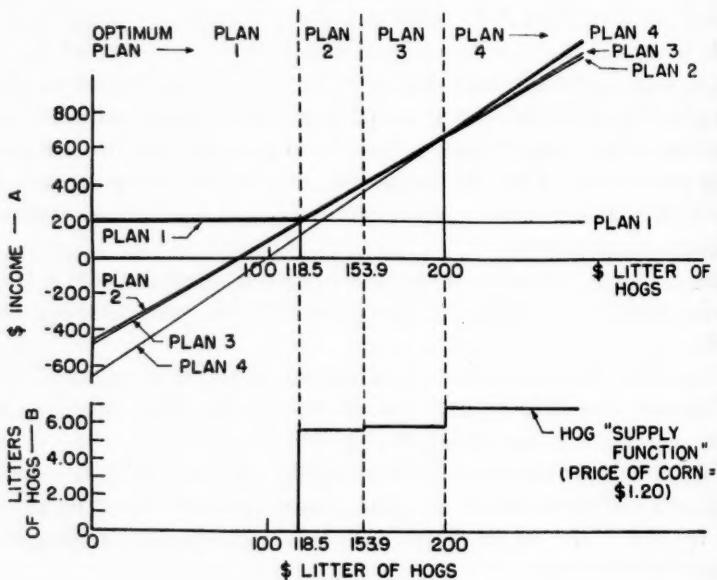

FIGURE 1

line indicates the maximum attainable income for the corresponding hog price. This figure shows that the general form of the income surface, as prices increase, is *concave from above*. This is a common-sense relation, since it is obvious that the worst a farmer can do is maintain his old plan and old rate of income increase. If an alternative plan becomes preferable, it is because income increases at a faster rate than with his old plan.[10] This basic production economics relation may be more important than is generally recognized since it suggests that as the support level increases, the burden of price supports on the general community tends to increase faster than at a simple arithmetic rate.

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[10] The rate of income increase will be faster *because the plan has a larger hog output.*

Plans 1 through 4 have been drawn vectorially in Fig. 1A. This shows how the higher hog outputs of successive plans progressively compensate for their higher initial costs. It also emphasizes that the income from a plan can vary even though, in real terms, the plan remains unaltered.

Figure 1B is the supply function for hogs,[11] with all other prices held constant; it relates the number of hog litters sold (column P_6 of Table 3) to the price per litter. There is a marked difference between this supply

TABLE 3. PLAN SUMMARY FOR ONE-PRICE-VARIABLE PROGRAMMING

| Plan num-ber | Activities | | | | | | | | | | Hog price range | | Income at $P_h = 0$ |
	Corn A P_1	Corn B P_2	Hogs A P_3	Hogs B P_4	Dairy P_5	Hog sell. P_6	Capital disp. P_7	Labor disp. P_8	Hog disp. P_9	Corn disp. P_{10}	Min.	Max.	
1	6.7	0	0	0	6.7	0	3,466.7	0	0	0	0	118.5	200.0
2	9.8	0	0	2.8	2.7	5.6	0	0	0	0	118.5	153.9	−469.1
3	0	4.8	0	2.9	2.8	5.8	0	0	0	0	153.9	200.0	−489.7
4	0	3.9	0	3.3	0	6.6	0	65.8	0	0	200.0	infinite	−649.2

function and the smooth curves of many textbooks. The supply function of Fig. 1B is, of course, for a single farm and may therefore contribute to an aggregate supply function which is essentially continuous. However, Fig. 1B *does* raise the question "should we think of a firm's supply function as being smooth or stepped?"

Summary of One-Price-Variable Programming

Two-price-variable programming is essentially an extension of one-price-variable programming. Since we are about to discuss two-price-variable programming on the assumption that the reader has fully grasped the methods of one-price-variable programming, it may be well to reiterate the main principles once again.

(i) Credit activities with their production, of the commodities whose price is to be varied, in real (or physical) terms. Give them no direct financial credit for this production.

(ii) Introduce the value of these products indirectly by including a selling activity.

(iii) Assign the selling activity the minimum price that is of interest.

(iv) Solve the problem set up in (i) through (iii) in the usual way.

(v) If the selling activity is not in the plan obtained from (iv), the first "border" price is given by increasing selling price by the z_j-c_j of the selling activity.

(vi) Having raised price to the "border" value, introduce the selling activity.

[11] We have quantity on the vertical axis and price on the horizontal axis, to emphasize the relation between hog price, hog output and income. The figure can be redrawn to give the standard arrangement of the axes.

(vii) As a result of (iv) or (vi) we have a plan that includes the selling activity. Divide the z_j-c_j by the negative entries in the selling activity row to get the ΔP_h row. The ΔP_h entries are recorded as positive figures.

(viii) The smallest ΔP_h indicates the (minimum) price rise necessary to give another "border" price.

(ix) New z_j-c_j's are computed to correspond to the price rise indicated by (viii).

(x) As a result of (ix) the new z_j-c_j of the activity with the smallest ΔP_h in (viii) will be zero, hence this activity can be introduced without sacrifice of income.

(xi) Steps (vii) through (xi) can now be repeated on the plan obtained in (x)[12] until we reach the maximum price of interest, or maximum output (the latter being indicated by a selling row with no negative entries).

Having discussed one-price-variable programming in detail, we will proceed to illustrate two-price-variable programming.

Example of Two-Price-Variable Programming

We have seen that a small modification of standard simplex rules enables us to follow the changes in the optimum farm plan, as price for one farm product varies. One way to allow the price of a second product to vary is to decide on a number of discrete prices, say $1.00, $1.20, $1.40, etc., for corn, and vary the price of hogs using the methods of the last section. This is, however, an inefficient procedure since it requires a series of iterations for each corn price. A more satisfactory approach is to allow both prices to vary. In practice it appears that the simplest computational rules follow if we alter first one price and then the other. This procedure may be described as "two-price-variable programming."

The heavy lines in Fig. 2 indicate the information obtained from Table 2. The horizontal arrow, A'B'C'D'E', represents Sections 2 through 6 of Table 2. Corn price remains at $1.20 and hog price ranges from zero to $200 per litter. In Fig. 2 the single primes refer to sections in Table 2, the unprimed letters to iterations of the solution to be described, and the double primed letters to "positions" that can be "inferred" without the necessity for computing the whole matrix. It is not immediately obvious that "positions" A", C", D" and E" can be "inferred" from Table 2, however, this inference follows from the fact that corn disposal can also be described as corn selling. If we say that the only scarce resource used in corn selling is corn; corn selling and corn disposal differ only in the amount they contribute to net revenue. Since corn selling contributes more than corn disposal, the former will always displace the latter. Hence, we may think of Column P_{10} of Table 2 as representing corn selling. In Section 2 (or A') of Table 2, z_{10}-c_{10} is 80¢, this positive

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[12] Each repetition yields a new plan and a new "border" price.

$z_j\text{-}c_j$ for corn selling means that if corn price was increased by 80¢, $z_{10}\text{-}c_{10}$ would be zero, and corn selling could be included in a new optimum plan without sacrifice of income. The c_j's of Table 2 have been computed on the assumption that corn costs $1.20; hence, an additional 80¢ gives a corn price of $2.00, indicating that at zero hog price, Plan 1 will be optimum unless corn price rises to $2.00 per bushel. Position A'' corresponds to this border price. Consequently, for zero hog price, $2.00 per bushel of corn is a "border" price. Similarly, $z_{10}\text{-}c_{10}$ of Section 4
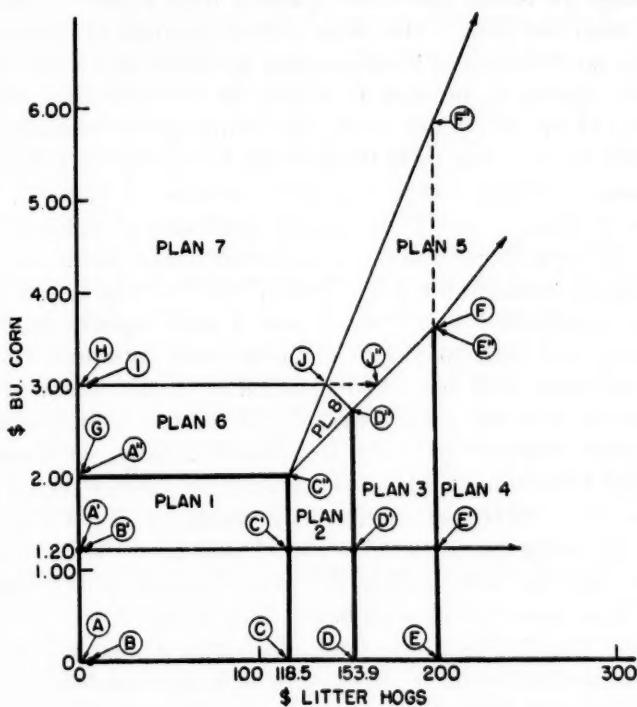

FIGURE 2

(or C') is 80¢ indicating that at a hog price of $118.50 per litter, corn price would have to rise to $2.00 (=$1.20 + 80¢) before another plan would become optimum. Section 5 (or D') indicates that Plan 2 is optimum at hog price $153.90 unless corn price rises to $2.71 ($1.20 + $1.51) and Section 6 (or E') indicates that Plan 3 is optimum at the hog price $199.96, unless corn price rises to $3.60 ($1.20 + $2.40) per bushel. Since no corn is sold at $1.20 per bushel, we can be sure that no corn will be sold at *less* than $1.20, and so Plans 1, 2, 3 and 4 will be optimum for corn prices between zero and $1.20 per bushel.

Now let us consider the significance of the previous paragraph. Taking position A' and Section 2 of Table 2, we know that Plan 1 is optimum

for $1.20 corn and $0 hogs. Since no corn is sold at $1.20, we know that no corn will be sold at a lower price; therefore, we can deduce that Plan 1 is optimum for $0 corn and $0 hogs. The latter pair of prices is represented by position A in Fig. 2. Since Plan 1 is optimum for A' and A, we can deduce that Plan 1 is optimum for all points on the line AA'. Similarly, the discussion of the previous section showed that at $0 hogs, corn selling will not come in until corn price rises to $2.00 per bushel (point A"). Hence, Plan 1 is optimum for the whole "border" AA". At $118.50 hogs we found that Plans 1 and 2 were equally attractive (we could go from one plan to the other without sacrifice of income). More-over, since no corn is sold in either plan we know that a fall in price of corn to $0 (giving us position C in Fig. 2) will not alter the relative profitability of the two plans. In the last paragraph we showed that corn price would have to rise to $2.00 (position C" of Fig. 2) before another plan became optimum (while hog price remains at $118.50). We may argue that if Plans 1 and 2 are equally profitable at points C and C", they will be equally profitable at all intermediate points; in this way we are able to establish the price "border" CC" of Fig. 2. The last para-graph also established that Plans 2 and 3 were equally profitable for $153.90 hogs and both $0 and $2.71 bushel corn (positions D and D"), hence these plans will be equally profitable for all intermediate corn prices and we have the price "border" DD" of Fig. 2. In a similar fash-ion, the price "border" EE" can be derived. Finally, we know that at both $0 and $118.50 hogs, Plan 1 is replaced by another plan when corn prices rise above $2.00 per bushel. As a result, at all intermediate hog prices in the range $0 to $118.50, Plan 1 will cease to be optimum at $2.00 corn, and we may deduce the price "border" A"C". These price "borders" have been drawn with heavy lines in Fig. 2.

The heavy lines in Fig. 2 represent information available from Table 2. That is information latent in the one-price-variable solution. Thus, when Table 2 is properly interpreted it tells us the optimum plan for any corn price between zero and $2.00 per bushel, and any hog price between zero and infinity.

We could also infer that the boundaries of Plans 2 and 3 were given by the light lines C"D" and D"E" respectively; however, this hypothesis should be confirmed. C" and D" represent two points on the boundary of Plan 2 and some other plan(s). If we know the boundary is a straight line, we can draw C"D" with confidence. There exists, however, the pos-sibility that the boundary consists of a series of linear segments; there-fore, we should derive the *direction* of the boundary at C" and D" be-fore definitely stating that the line C"D" is the boundary.

In two-price programming the simplest procedure is to start with the minimum prices that are of interest, i.e., in this case price of hogs equals

zero ($P_h = 0$) and price of corn equals zero ($P_k = 0$). The data of Table 1 have been used to obtain Section 1 of Table 4. The second to last line of Table 1 is used for the enterprises' c_j values. The reader will recall that these c_j's were computed for zero corn *and* zero hog price.

Section 2 of Table 4 is the optimum plan for zero-hog and zero-corn price.[13] That Plan 1 *is* the optimum plan with zero price on hogs and corn, follows from the fact that none of the z_j-c_j's are negative. The reader will note that the input-output coefficients of this section correspond to the coefficients from Section 2 of Table 2. The z_j-c_j's of all activities except corn selling are the same, and corn selling now has a z_j-c_j of $2.00. This $2.00 is the amount that corn price would have to rise before corn selling would "come in," and we note that the 80¢ z_j-c_j of corn selling in Section 2 of Table 2 also indicates that corn price would have to rise to $2.00 ($=$1.20 + 80¢$) before corn selling would "come in."

Section 2 of Table 4 corresponds to point A in Fig. 2. By following the rules of one-price-variable programming for an increase in hog price, we can find the sections corresponding to points B, C, D and E[14] in Fig. 2. From these points, the $z_j - c_j$ for corn selling tells us how much corn price must rise before another plan becomes optimum and, hence, enables us to locate points A″, C″, D″ and E″. E is the optimum for all hog prices in excess of $200 per litter (the price of corn being zero). At E we fix the price of hogs (at $200) and allow corn price to vary, i.e., we introduce corn selling at price $3.60 per bushel and move to point F. At F we discover that a further increase in corn price of $2.23, would lead to hog selling "going out." Removing hog selling from the plan, corresponds to a plan which is *independent of hog price* or is *entirely dominated by corn price* and hence will be found when we increase corn price from position A to the maximum corn price of interest. From F we can infer the position of F″, and the activities that will be in the new plan. F has activities P_2, P_4, P_6 and P_9; the smallest corn price necessary to change the plan, and smallest R, indicate that the new plan at F″ will have activities P_2, P_6, P_7 and P_9. Having found the corn price at which hog selling goes out, we return to point A (Section 2 of Table 4), and using the rules of the last section, increase corn price when hog price is zero. In this way, varying corn price, we find the plans associated with points G and H. H represents the plan with maximum corn output, and

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[13] To conserve space we have omitted the simplex iterations that would normally intervene between Sections 1 and 2 of Table 4.

[14] To conserve space Table 4 only gives the simplex sections corresponding to points H, I and J in Fig. 2. The simplex iterations corresponding to points A through G are obtained by application of the rules for one-price-variable programming to Section 2 of Table 4. Sections 3 through 6 of Table 4 are sufficient to illustrate the *new* principles introduced when *two* prices vary.

TABLE 4. EXAMPLE OF TWO-PRICE-VARIABLE PROGRAMMING*

		Disposal activities				Real activities							
cⱼ → ↓	Resources or product supply P₀	0 Capital P₇	0 Labor P₈	0 Hogs P₉	0 Corn sell. P₁₀	-10 Corn A P₁	-23 Corn B P₂	-80 Hogs A P₃	-170 Hogs B P₄	40 Dairy P₅	0 Hog sell. P₆	R	Section
Capital P₇	5,000	1	0	0	0	200	395	1,000	1,050	30	0	—	**1.**
Labor P₈	200	0	1	0	0	10	20	20	15	20	1	200	
Hogs P₉	0	0	0	1	0	-10	0	-1	-2	0	-1	0	
Corn P₁₀	0	0	0	0	1	10	-21	10	25	10	-1	200	
-10 / -0 / 40 / 3.00 zⱼ-cⱼ *Plan 1*													
P₇	5,466.662	1	-7.667	0	12.334	0	-17.334	970.000	1,243.336	0	-7.667		**2. A.**
P₁	6.667	0	0.053	0	-.067	1	2.067	0	-1.167	0	0.053		
P₉	6.667	0	0.033	1	0.033	0	0	-1.000	-2.000	1	1.000		
P₁₀	200.001	0	1.000	0	2.000	0	-.033	1.000	1.333	-40	0.033		
-23 / -0 / 3.00 zⱼ-cⱼ *Plan 1*							1.000	120.000	235.000		1.000		
P₇	1,049.527	1	-19.752	19.752	0	2.498	0	604.932	753.665	-365.068	-19.752		**3. H.**
P₂	10.001	0	0.050	-.050	0	0.500	1	1.000	0.750	1.000	0.050		
P₁₀	210.024	0	1.050	1.050	1	0.500	0	-1.000	-2.000	31.003	1.050		
P₅	399.985	0	2.000	-1.050	0	0	0	31.003	40.754	29.998	2.000		
-23 / +0 / 3.00 zⱼ-cⱼ *Plan 7*								149.998	274.996				
P₇	1,049.527	1	-19.752	0.098	0	2.498	0	585.180	714.161	-365.068	-19.752	1.5	**4. I.**
P₁	10.000	0	0.050	-.074	0	0.500	1	1.050	0.850	1.000	0.050	11.8	
P₅	210.024	0	1.050	1.055	1	0.500	0	-1.000	-2.000	31.003	1.050	—	
P₄	399.985	0	2.000	-2.235	0	0	0	42.025	42.854	29.998	2.000	4.9	
-170.00 / -23.00 / 139.50 / 3.00 zⱼ-cⱼ						*	*	149.998	274.996		*		
ΔPh *Plan 5*			36.151	187.498	*	*	*	149.998	137.498		*		
P₄	1.470	0.001	-.028	0.098	0	0.004	0	0.819	1	-.511	0	367.5	**5. J.**
P₈	8.752	-.001	0.074	-.074	0	0.497	1	0.354	0	1.435	0	17.6	
P₅	2.989	0.003	-.055	1.055	1	0.007	0	0.659	0	-1.022	1	419.8	
P₁₀	147.046	-.060	2.235	-2.235	0	0.350	0	-3.061	0	52.910	0	410.1	
-170.00 / -23.00 / 139.50 / 3.00 zⱼ-cⱼ	399.985	0	36.151	187.498	*	0	*	12.499	*	29.342	*		
ΔPh *Plan 5*													
P₄	1.408	0.0014	-.028	0.028	0	0	-.007	0.817	1	-.521	0		**6. J.**
P₈	17.608	-.002	0.148	-.148	0	1	2.012	0.711	0	2.887	0		
P₅	2.816	0.0028	-.056	1.056	1	0	-.014	0.634	0	-1.043	1		
P₁₀	140.880	-.059	2.184	-2.184	0	0	-.705	-3.310	0	51.899	0		
-170.00 / -10.00 / 139.50 / 3.00 zⱼ-cⱼ	399.985	0	2.000	187.498	0	0	0	12.499	0	29.998	0		
Plan 8													

* The figures in this table have been rounded to three decimal places. It is believed that the reader will have no difficulty in following the computations. Both P₁ and P₄ are marked to come in after Section 5. P₁ yields Plan 5 (or Section 6). P₄ would yield Plan 8 (see Table 3).

hence it is the optimum plan for all corn prices in excess of $3.00 per bushel (hog price being zero). Since H is the plan with maximum corn output (all elements in the corn-selling row are positive), we "fix" corn price (at $3.00) and let hog price rise. At $2.00 per litter, hog selling comes in (at zero level) to replace hog disposal. A further rise of $137.5 leads to Plan 3 being replaced by Plan 5; with $3.00 corn and $139.5 ($=0 + \$2.00 + \$137.5$) hogs, we are at point J in Fig. 2. Point J″ can be inferred from J, and we can tell that at J″ the new plan would be Plan 3.[15] That J″ corresponds to a plan we already know, follows from the fact that corn selling is forced out, i.e., corn selling makes no contribution to income at J″, hence income depends on hogs alone, and the plan will have been found when we had a corn price of zero.

Two important questions remain to be answered, "How do we know the *direction* of lines such as C″J, JF″, JD″ and so on?" and "How do we know that plans numbered 8 and 5 in Fig. 2, are not the same?" To facilitate the discussion of these questions, Table 4 gives details of the steps from H to J. Section 3 of Table 4 gives Plan 7 at point H (this section is the "result" of raising the price of corn by $1.00 per bushel from point G).[16]

There are no negative coefficients in the corn row of Section 3 of Table 4, it follows that none of the activities will increase corn production and hence this plan corresponds to maximum corn output. We next wish to know the optimum plans for $3.00 corn as hog price increases. For hog selling to come in, hog price has to increase from zero to $2.00 per litter. This adjustment is represented by the move to Section 4 of Table 4, which is similar to the move from Section 2 to Section 3 of Table 2. Dividing by the negative hog-selling coefficients of Section 4, we discover the minimum increase in hog price ($137.50) necessary to make another plan optimum. Using the rules of one-price-variable pro-

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[15] At point J, P_2, P_4, P_6 and P_{10} are in the plan. The ΔP_h row tells us that a rise in hog price of $29.34 will lead to P_8 coming into the plan. Computing the R ratios we see that P_{10} (corn selling) would "go out," giving us a new plan consisting of P_2 P_4, P_8, P_6; but this set of P's describes Plan 3 (see Table 3), hence we know the position of J″ ($3.00 corn and $168.8 hogs) and the new plan.

[16] We should, perhaps, explain the meaning attached to the term "position" or "point." By "position" or "point" we refer to a position or point in Fig. 2. Every point in this figure can be identified uniquely by two coordinates (the price of corn and of hogs). "Plan" on the other hand has its usual meaning in that it refers to a set of activities carried on at positive levels. Note that Sections 3 and 4 of Table 4 represent the same plan, since they have the same activities carried on at the same levels (whether P_9 or P_6 is carried on at zero level does not affect the plan). Sections 5 and 6 of Table 4 represent the same point, since the prices of corn and hogs are the same, even though the *plan* has changed. An important property of variable-price programming is that at the border of two plans the income is the same, and hence, at the border, knowledge of the price coordinates does not uniquely define the plan that will be pursued.

gramming we bring in P_4 and compute the new z_j-c_j's to obtain Section 5. A hog price of $139.50 and corn price of $3.00 corresponds to point J in Fig. 2. Dividing the z_j-c_j of Section 5 by the negative hog selling coefficients we discover that the minimum rise in hog price necessary to change the plan is $29.34. This change would result in P_5 replacing P_{10} (corn selling), hence it would give a plan (P_2, P_4, P_5 and P_6), which sells no corn. This means that the plan is given by one of the plans found for zero (or $1.20) corn price. Looking at Table 3 we observe that Plan 3 (optimum for hog prices $153.9 to $200.0) consists of P_2, P_4, P_5 and P_6. Hence from Section 5 of Table 4 or position J we can infer that at $3.00 corn and $168.80 hogs,[17] (position J″) Plan 3 becomes optimum. In a similar way F″ can be inferred from F.

By looking at Section 5 of Table 4 we see that there are two activities not in the plan that have zero's in the z_j-c_j row (P_1 and P_7). Hence, either of these activities (P_1 or P_7) could be introduced into the plan without loss of income. Looking at P_1 we observe that the coefficients for both the hog and corn inputs are positive, hence a very small decline in the price of either corn or hogs would lead to Plan 5 becoming sub-optimum. The input coefficients of hogs and corn for P_7 are positive and negative respectively; a slight rise in corn price or fall in hog price would lead to another plan becoming optimum. We note that the introduction of P_7 would "take us back" to Plan 7, and that there is some critical combination of price increases for corn and hogs that will leave z_7-c_7 of Section 5 zero. Thus if we represent the changes in corn and hog price as ΔP_k and ΔP_h respectively we see that z_7-c_7 of Section 5 remains zero so long as

$$-0.060\Delta P_k + 0.003\Delta P_h = 0 \qquad (9)$$

or

$$\Delta P_h = \frac{0.060}{0.003}\,\Delta P_k$$

$$\Delta P_h = 20\Delta P_k \qquad (10)$$

Letting $\Delta P_k = 1.00$, so that total corn price if $4.00 ($3.00 + $1.00) we see that a change of $20 in hog price (giving a total hog price of $159.50) would leave z_7-c_7 zero. This enables us to draw the line JF″, and in this way equation (10) defines the border between Plans 5 and 7.

By putting the argument of the last paragraph more formally, and by recalling the derivation of equation (4), we may observe that alterations in the price of corn and hogs will lead to a new z_j-c_j, which may be represented z_j-c_j*:

$$z_j\text{-}c_j{}^* = z_j\text{-}c_j + \Delta P_k \cdot k_j + \Delta P_h \cdot h_j \qquad (11)$$

_____

[17] This is the hog price of Section 5 ($139.50) plus the minimum rise in hog price necessary to make another plan optimum ($29.34).

where k_j and h_j are respectively the corn and hog input coefficients of the j-th activity. So long as $z_j-c_j^*$ does not become negative the original plan remains optimum, i.e., provided

$$z_j-c_j^* \geq 0 \qquad (12)$$

When $z_j-c_j = 0$ (as for P_1 and P_7 in Section 5) the conditions $z_j-c_j^* \geq 0$ reduces to:

$$\Delta P_k \cdot k_j + \Delta P_h \cdot h_j \geq 0 \qquad (13)$$

or

$$\Delta P_h \geq -\frac{\Delta P_k \cdot k_j}{h_j} \qquad (14)$$

This is the logic behind equation (10) above. For P_1 in Section 5, (14) gives:

$$\Delta P_h \geq -\frac{0.350}{0.007} \cdot \Delta P_k$$

$$\geq -50\Delta P_k$$

Hence for $\Delta P_k = -1.00$ ($P_k = 2.00 = 3.00 - 1.00$), $\Delta P_h = 50$, ($P_h = 189.50 = 139.50 + 50.00$). This enables us to draw the line, JD", which defines the boundary between Plan 5, and the plan resulting from the introduction of P_1. Section 5 shows that P_1 will replace P_2, giving a plan defined by P_1, P_4, P_6 and P_9. An examination of results obtained reveals that none of the seven plans previously found has this combination of activities. Hence the introduction of P_1 will give a new plan, Plan 8. This new plan has been computed in Section 6 of Table 4.

The zero z_j-c_j's of P_7 and P_2 of Section 6 of Table 4 enable us to derive the borders between Plan 8 and Plans 5 and 1. Similarly, if space permitted presentation of the complete solution we could give the derivation of the other important borders from the other iterations of the solution.

Figure 3 and Table 5 summarize the results of two-price-variable programming in a form that should be easily understood by the layman. We emphasize that the figure and table present the optimum programs for *all possible corn-hog price ratios and combinations.*[18]

The rules for two-price programming might be summarized:

1. Formulate the problem with two selling activities and credit the producing activities with their products in real, or physical, terms.

2. Find the optimum plan (Plan A) for the minimum prices that are of interest.

3. Fix the first price and vary the second (following the rules for one-

[18] Plans such as 5 should be checked at very high corn and hog prices, to see that no other activity will come in. In the example Plan 5 remains optimum even at $50 a bushel for corn and $2,000 per litter of hogs.

variable-price programming) until it reaches the maximum value of interest (B).

4. Fix the second price at B and vary the first until it reaches the maximum value of interest.

5. Return to Plan A, and vary the first price to the maximum price of interest (C).

6. Fix the first price at C and vary the second to the maximum price of interest.

7. Interpret results, find the area of ignorance, and repeat Rules 2 through 7 until the whole area of interest is known.

"The maximum price of interest" may be a specific price, it may correspond to maximum corn output, or it may be the point where corn selling goes out. Thus we may be interested in farm plans for the price ranges of $1.00 to $1.50 for corn and $10.00 to $20.00 per cwt. for pork. In this case we would include both corn and pork-selling in the original matrix. We would assign them prices $1.00 and $10.00 respectively and find the optimum plan. We would then raise corn price (using the rules for one-price-variable programming) until we had found the optimum plans and "border" prices for corn prices between $1.00 and $1.50, pork price remaining fixed at $10.00. We next increase pork price to $20.00, thus finding the plans and "border" prices for $1.50 corn and pork prices between $10.00 and $20.00. Returning to the optimum plan for $1.00 corn and $10.00 pork we increase pork price until we know all plans and "border" prices for $1.00 corn and pork prices between $10.00 and $20.00. Fixing pork price at $20.00 we raise corn price until we again have the optimum plan for $20.00 pork and $1.50 corn.

Alternatively, we may be interested in the optimum plan for *all* corn and pork prices. In this case Rule 2 leads to the optimum plan (Plan A) for zero corn and pork prices. "The maximum value (B or C) of interest" in rules 3 or 5 is the value at which the maximum corn or pork output is attained. "The maximum value of interest" in Rule 4 or 6 is the value at which corn or hog-selling 'goes out."

We also refer to an "area of ignorance." Rules 2 through 6 result in our "bordering" the price area that interests us. If we are lucky, this bordering process will enable us to infer the optimum plans for the whole area. More usually, however, there will be an area (such as that occupied by Plan 8 in Fig. 2) where the plan(s) cannot be inferred from the bordering process. Once the results of Rules 2 through 6 have been interpreted and mapped onto the price diagram, the price coordinates of the "area of ignorance" will be known, and new price limits can be specified. Repetition of Rules 2 through 6 will map a new portion of the area of ignorance. Consequently the area of ignorance may be progressively reduced and finally eliminated.

General Remarks

Probably the most striking feature of the methods outlined above is their *economy*. An almost infinite number of discrete price programs could be computed without the investigator having the same clear view of the production surface that is provided by one series of variable-price-programming computations.
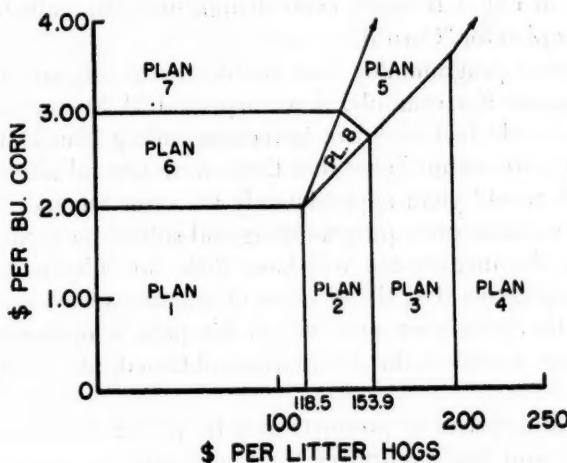

FIGURE 3

TABLE 5. PRICE—PROGRAM MAP AND PROGRAM SUMMARY

Plan number	Real activities				Production		Income net of corn & hogs
	Corn A P_1	Corn B P_2	Hogs B P_4	Dairy P_5	Hogs P_6	Corn P_{10}	
1	6.67	0	0	6.67	0	0	−200.00
2	9.77	0	2.82	2.71	5.66	0	−469.06
3	0	4.76	2.89	2.78	5.78	0	−489.71
4	0	3.91	3.29	0	6.58	0	−649.23
5	0	8.75	1.47	0	2.94	147.04	−451.15
6	20.00	0	0	0	0	200.00	−200.00
7	0	10.00	0	0	0	210.00	−230.00
8	17.61	0	1.41	0	2.82	140.88	−415.80

Figures 1B and 3 provide us with a normative supply function. Since the normative supply varies by discrete jumps, the supply function can be used to specify optimum support prices or soil bank prices whether the aim is to increase crop production, decrease crop production, or to increase farm income with a minimum increase in production. In Fig. 1, if the government wishes to increase hog production, and if farmers make optimum adjustments, increasing hog price from $118 to $119 per litter

would increase hog supply from zero to 5.7 litters. Raising price by another $80 per litter will only increase hog production by another .12 litter, *while raising farm income by $460*. Thus we appear to have, at least ideally, a powerful aid to policy decisions.

Variable-price programming provides an economical way of deriving alternative plans that can reasonably be expected to be good alternatives to the optimum plan. The financial sacrifice in following Plan 2 rather than Plan 3 in Fig. 1 is small, even though one plan calls for "Corn A" and the other plan for "Corn B."

Variable-price programming also enables us to estimate the "reliability" of programs. For example, if we expected $1.20 corn and $50 hogs in Fig. 3 we would feel confident in recommending Plan 1. At $2.00 corn and $120 hogs we would know that there were several alternative plans, any of which would yield approximately the same income. If a program is set up for variable-price programming and solved for a particular price combination, the investigator will have little difficulty in adapting the methods given above (i.e., the solution of equations such as (6) and (11) to discover *the price area* over which his plan is optimum); the new process greatly increases the information obtained, at virtually no extra cost.

Cost as well as prices of products may be varied. Indeed the "cost" of corn to dairy and hog enterprises has been varied in our example. Our method is not, however, easily applied to problems where a change in price affects an *input coefficient*. As, for example, where corn buying is in the plan, a rise in corn price will affect the capital coefficient for corn buying. We believe the method can be extended to cover this case, but have not yet made the necessary extension.

We can modify the computing rules to give the minimum *decrease* in hog or corn price to make a plan suboptimum. We divide the z_j-c_j by any *positive* entries in the relevant row, and *subtract* the product of this minimum price and relevant input coefficient from the old z_j-c_j to get the new z_j-c_j. Variable-price programming may be combined with continuous programming. In this case we must find the price change necessary to make another d_j more negative than the most negative d_j at the present price. We have done a little work experimentally along these lines, but do not expect to formulate any rules until we have a problem that needs a combination of these two techniques.

Finally we should add the conventional *caveat* that the merit of empirical studies rests upon the accuracy of the data used and assumptions made. In the presence of erroneous input coefficients, variable-price programming will yield a series of erroneous "answers" rather more efficiently than previous methods.

RENT REDUCTION AND TENURE SECURITY
IN FREE VIET NAM

PRICE GITTINGER
International Cooperation Administration

FREE Viet Nam, in common with many other nations of the Free World, faces a critical problem of enlisting peasant loyalty and raising rural levels of living. As a principal component in its search for a solution, the government of Viet Nam since early 1955 has carried out an agrarian reform that reduces rent to 25 per cent of the crop, regulates other tenure conditions, and provides tenure security for peasants who undertake to cultivate abandoned land.

The effort of this southeast Asian nation to improve its tenure structure merits critical examination by agricultural economists and political scientists concerned with preserving the values of the Free World. The agrarian reform must be carried out in a nation still racked by internal Communist subversion, and in areas where the Communist Viet Minh formerly was in occupation and had promised "reforms" of its own. The reform is being carried out entirely by the civil mechanisms of a free government without the intervention of an over-riding military machine. It must be implemented in a nation desperately short of qualified administrators and in a nation where government revenues are critically short. For national and provincial administration, the government must depend upon administrators of urban orientation, often drawn from land-owning classes, since tenant groups lack the educational background. The government has relied heavily upon the United States for technical advice and local currency financing for administrative costs. This has been provided through the International Cooperation Administration and its United States Operations Mission to Viet Nam. Finally, the American officials have played an important part in convincing top government administrators of the need for agrarian reform.

Geographically, Viet Nam clings to the extreme southeastern corner of Asia. The 17th parallel was defined by the Geneva Convention of July 1954 as the artificial boundary between Free Viet Nam and its Communist counterpart. Southward, the nation stretches along the coast and through the mountainous Annam Cordillera to the broad Mekong delta. Twelve million people live in this new nation, nine million of them in rural areas.[1] They are concentrated into packed coastal deltas which

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[1] Reliable agricultural data about Free Viet Nam are almost nonexistent. Figures used in this article represent the best available estimates and are based principally upon Vietnamese government sources, United States Operations Mission estimates, and published sources where available and reliable. The best published source, despite its age, is Yves Henry, *L'Economie Agricole de l'Indochine* (Hanoi: Gouverne-

stretch like a necklace along the coast and in the huge pendant formed by the Mekong delta. Approximately five million people live in tenant households, three million comprise landless laborer families, and the remaining one million live in owner-operator or landlord households.

Traditionally, rents have been 50 per cent of the crop for the land alone, with all labor, fertilizer, seeds, draft power, and equipment provided by the tenant or rented at extra cost. Tenants had no security of tenure. They could be removed at the landlord's will as the result of sale, whim, or fancied insult.

The pattern of tenure is divided sharply between the coastal deltas which comprise Central Viet Nam and the Mekong delta which forms South Viet Nam.[2] The CVN coastal deltas are characterized by very small holdings. Tenants often own one or two tenths of an acre, and may rent another half acre or acre. Landlords own comparably small areas, and a rich owner may have only 12 acres. Holdings of more than 100 acres are virtually unknown. Up to half the area in many villages is owned as communal land that is either rented to landless villagers in units of one or two tenths of an acre, or is cultivated in common by the landless families. Rice is the dominate crop, but manioc and sweet potatoes are common. Rice yields are low and extremely variable, depending largely upon water control, and run from 600 to 1,300 pounds annually per acre from two and sometimes three crops.

In South Viet Nam, holdings are substantially larger. The average tenant unit is around 5 acres, and holdings commonly run from 2 to 15 acres. This area has been settled by the Vietnamese within the last 250 years or so, and vast tracts were given as concession lands by the French colonial administration to French and Vietnamese who had capital enough to dig canals for irrigation and drainage. About half the land is owned in units of 250 acres or more, and most large owners now are

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ment Général de l'Indochine, Inspection Générale de l'Agricole, de l'Elevage et des Forêts, 1932), now out of print and virtually unobtainable. Two good English sources are Pierre Gourou, *Land Utilization in French Indochina* (New York: Institute of Pacific Relations, 1945), mimeo., and Office of Foreign Agricultural Relations, *The Agriculture of French Indochina* (Washington: United States Department of Agriculture, 1950), mimeo. The sources used for information on agrarian reform activities in Viet Nam are principally working files of the author and the United States Operations Mission to Viet Nam.

[2] The entire area south of the 17th parallel is often referred to as South Viet Nam to distinguish it from neighboring Communist North Viet Nam. Within Free Viet Nam are three major regions: Central Viet Nam, South Viet Nam, and the sparsely-settled Southern Mountain Plateau (which is unimportant from the standpoint of agrarian reform). In this article, to distinguish the major regions from the nation, Free Viet Nam refers to the nation as a whole south of the 17th parallel, and Central Viet Nam (CVN) and South Viet Nam (SVN) refer to the two most important regions within the nation.

Vietnamese. Rice yields in this area are substantially higher, running from 1,000 to 1,500 pounds per acre for a single crop.

Prior to World War II, the agricultural policy of the French colonial administration centered on irrigation and drainage, crop research unaccompanied by agricultural extension, development of plantation crops grown largely outside the rice deltas, and upon helping large land owners. Little was done to aid individual peasant farmers directly, and almost nothing for tenants. Even the agricultural credit schemes were directed largely at owners who pledged land for security and in turn lent money to their tenants at high interest.

In 1946 civil war broke out as resistance to the French efforts to reestablish their prewar administration. The leading unit of this opposition, although not the only political element strongly in favor of independence, was the Communist Viet Minh. Gradually the Viet Minh came to control more and more of the rural areas until by the time of the Geneva Convention, Viet Minh troops controlled virtually all of what is now North Viet Nam, and substantial proportions of the rural sections in Free Viet Nam.

The Viet Minh, in order to maintain Communist troops, was able to draw on the new status they accorded cultivators, on peasant dislike of the French, and on fear. From area to area Communist administration varied widely, but in general rents were greatly reduced or eliminated, and heavy taxes in kind were levied. Records of land ownership were destroyed. Constant propaganda effort was devoted to convincing peasants that the Communists had their best interests at heart and to trying to inject class hatred into rural communities. No attempts were made at collectivization.

In Central Viet Nam, where Communist control was highly organized, immediate elimination of rent or dispossession of small landlords was impractical. Instead, rents were reduced, and the Viet Minh administrative officers took great care to demonstrate their concern for tenants. In one village for example, a peasant related the rent collection process. All the paddy was collected in his thatched home. The tenant, the landlord, and the Viet Minh agent gathered to divide the crop. The agent first divided the pile of paddy in two, giving half to the landlord and half to the tenant—the traditional division. Then he split the landlord's half into three portions, and physically gave a generous third to the tenant, leaving him with a total of about two-thirds of the crop. However, the Viet Minh agent then promptly taxed both parties 50 per cent in kind so the tenant wound up finally with one third of the crop, the landlord with one sixth, and the Viet Minh with half. To get around this heavy tax, the tenants in this village shifted to manioc which the

Communist guerrillas found less palatable and so taxed less heavily. In another CVN village a landlord owning 12 acres related how he was neither permitted to sell his land nor to keep his crop. The Viet Minh kept him almost a prisoner to use him as a "bad example."

In South Viet Nam, where the Communists were much less completely in control, administration was less rigorous. As Viet Minh guerrillas gained night-time and marshland control, the area became physically unsafe for landlords to visit, and some tenants paid no rent at all for nearly eight years. Viet Minh tax collections were onerous, usually obtaining more than half the crop with added special collections. In one of the areas under Viet Minh control, a peasant told of producing a crop of 22,000 pounds, and paying a tax in kind of approximately 1,400 pounds for each of five members of his family, plus a basic 15 per cent over-all tax and occasional special assessments which ran the total tax well over 50 per cent. Although the Viet Minh admonished tenants to cultivate "all the land you want," the general insecurity, deterioration of irrigation and drainage facilities, and destruction of draft animals so greatly reduced the area under cultivation that by 1954 only two thirds of the prewar area was sown to rice.

Measured in terms of physical well-being, the tenant was no better off under the Viet Minh than when he paid 50 per cent rent to a landlord. The big difference was his viewpoint. No longer did the tenant feel the tax represented an unjust exaction—economic exploitation. The Communist leadership convinced large numbers of rural people that to the Viet Minh the common man really mattered. Economic imposts and other hardships were depicted as self-imposed by the multitude to further the common fight. In many areas non-Communist farmers collected the tax themselves without much help from armed Viet Minh troops as a voluntary contribution to the "People's War for Liberation." After a century of paying heavy rent to landlords, this altogether new approach paid off handsomely. Farmers were flattered by the Viet Minh attitude of taking them into their confidence and consulting them. For the first time the tenant farmer felt he had a real status in his community and a real dignity. Support for the Viet Minh followed naturally.

To counteract Communist peasant support, the French and the semi-independent Vietnamese Government sought a land reform policy which would regain rural loyalty. The first evidence of interest in agrarian reform came in the Vietnamese New Year message of Emperor Bao Dai in February 1951. He promised regularized tenancy agreements and credit control, although quickly adding, "without, of course, impairing the interests of the established large land owners. . . ." He also promised that peasants who had been given land by the Communists would be allowed

to retain their holdings when the "troubles" were over. But the message was entirely a propaganda move, and produced nothing tangible. The influence of land-owning interests remained high and the need for genuine changes in tenure institutions went unfilled.

Matters were allowed to slide for 2 years with only scattered and token reference to tenure conditions. Meanwhile, Communist gains continued, and it became painfully evident some move to reform the conditions under which land was held and operated must be made. Even so, the government was not yet ready to face the problem realistically.

In the early spring of 1953, President Nguyen Van Tam, partly in a move to gain political strength at the expense of Bao Dai and partly to counteract Communist propaganda, dramatically announced that henceforth the prewar rent of 50 per cent of the crop would be reduced to no more than 15 per cent. Although he gave wide publicity to the decree, it was evident from the start that it could never be enforced.

Official American advisers, meanwhile, had been urging the promulgation of a real agrarian reform code. Events forced action, and a long-dormant National Committee for Agrarian Reform met to draft agrarian reform legislation. Although the American technicians were informally consulted about the proposed laws, the Vietnamese did not await their formal technical analysis before promulgating four ordinances in June 1953.

These ordinances provided for the return of uncultivated land concessions to be reallocated to small farmers; regularized tenure relationships with written leases following a prescribed form; a maximum rent of 15 per cent; a minimum of three years tenure security; maximum land holdings running from 30 acres in North Viet Nam to 250 acres in the South; and for the government to allot to tenants any uncultivated land, depositing the rent to the account of absent owners.

Again, these ordinances were motivated largely by propaganda considerations, and their shortcomings must be seen in this light. Most striking among these was the failure to include any enforcement measures. Another was the unrealistically low 15 per cent rental. The wording was vague and sometimes contradictory. The impractical complexity of the ordinances provided for many possible variations to meet differing conditions, but made them too complicated to be enforceable or for tenants to understand. Although the Americans and Vietnamese familiar with rural conditions recognized these shortcomings, they were unable to remedy them.

After the partition of Viet Nam following the Geneva Convention in 1954 and the accession of Ngo Dinh Diem as President, agrarian reform was given fresh consideration. In this, the Americans rendered valuable

technical assistance, and indeed were persistent advocates of action.

The goals of agrarian reform were clear: (1) to stabilize rural conditions and to gain tenant loyalty by injecting a prospect for economic improvement in a peaceful environment; and (2) to provide incentives for tenants to recultivate idle land. These objectives were fully in accord with the new Diem Government which was struggling against internal opposition from armed bandit and sect groups and against continuing Communist subversion.

During the fall of 1954, the Americans and the French, who also agreed on the need for agrarian reform, worked together on a unified position. They agreed that the government was not yet in a position to embark on a land transfer program, and that the immediate goals could be realized by a sincere rent reduction and tenure security program. It was felt, however, that land transfer would have to come later.

Agrarian reform constituted a principal point in the program of General J. Lawton Collins, President Eisenhower's special representative. Accordingly, in December 1954, General Collins called upon President Diem to present the American viewpoint, and later the same day the French High Commissioner, General Paul Ely, called to present an identical French position. Within hours, President Diem had issued instructions to his government, and the Vietnamese, French, and American agricultural specialists were seated around a conference table. There was no difficulty agreeing on the general terms of the new ordinances. The basic needs and mechanisms to achieve them had been carefully threshed out between the French and Americans earlier, and they were known to be in accord with the Vietnamese thinking. The conferences worked quickly, and the President promulgated Ordinance No. 2 regularizing tenancy and limiting rents on January 8, 1955 and Ordinance No. 7 governing recultivation of abandoned land on February 5, 1955.

Ordinance No. 2 (which technically amended one of the 1953 ordinances) provided the following: (1) All established tenants must have a written contract following a prescribed form and registered in their village. (2) Rents must be set at the more realistic rate of 15 to 25 per cent of the principal crop depending on the fertility of the land. (3) Annual rent for tools, draft animals, etc., could not exceed 12 per cent of their value and loans to tenants could not exceed 12 per cent annual interest. (4) Contracts must last for at least 5 years and be renewable at the tenant's option. (5) Village and district agrarian reform committees would be formed which, with the provincial committees established by the 1953 legislation, would administer the program, report abandoned land, and arbitrate disputes. (6) Failure to comply with the ordinances was made punishable with stipulated penalties.

Ordinance No. 7 provided the following: (1) Communal councils would forward to the government a list of arable land not cultivated the prior season. (2) Land-owners must declare their intention either to lease abandoned land or to cultivate it themselves, or else they would be considered as absent. (3) Landlords considered present would sign a prescribed contract with new tenants which reduced the normal 15 to 25 per cent rent but exempted the landlord from liability for land taxes. (4) Where the landlord was considered absent, abandoned land could be let by the communal council to tenants, again using a prescribed contract form. These tenants on recultivated land would pay no rent the first year and reduced rent the next two years. The rent collected would be held to the account of the owner. The ordinance automatically expired on December 31, 1955 and was replaced by Ordinance No. 28 of April 30, 1956 reinstating the same provisions on a permanent basis.

To aid in the implementation of each of these ordinances, a mandatory contract form was appended to them. Three different contracts were provided. Appended to Ordinance No. 2 for established tenants was the so-called Type A contract. This contract embodied the terms of the ordinance relating to land rent, annual rent for equipment and animals, interest on loans, and the duration of the contract. Appended to Ordinance No. 7 governing abandoned land were the two other contracts: Type B for use where the landlord was known, and Type C for use by communal councils where the landlord was absent. These, too, embodied the terms of the ordinance relating to tenancy conditions.

In framing these two ordinances, an explicit attempt was made to correct obvious deficiencies and to take advantage of prior experience in other Asian nations. American technical help showed to best advantage here, since U. S. advisers had had experience in Japan, Taiwan, and the Philippines. To allow the rent to range from 15 to 25 per cent was partly a political expedient, since the government was saddled with the unrealistic rate publicized in earlier propaganda efforts, but this provision was also an attempt to relate rent to the productivity of the land. The establishment of local committees was urged by the American officials both as a means of providing a local administrative unit and as a desirable device to encourage democratic growth. The general terms of the ordinances were simplified to make administration possible, and the focus of emphasis was narrowed to rent reduction, interest control, and tenure security. The model contract was retained to make the law easier to administer. And, of course, the inclusion of penalties corrected a glaring omission.

In human terms, the impact of the new code can most easily be seen by its effect on a tenant farmer's budget. Nguyen Van Thanh, a "typical"

farmer interviewed in the South, rents a holding very near the average of 7 acres. His wife and three children must live largely off the rice the family can grow, plus their chickens and the fish from nearby canals. Thanh produces 4⅗ metric tons of rice, of which his landlord from Saigon traditionally collected half. He must save out 1⅔ tons for family consumption and seed, leaving some ⅘ ton—worth $25.00—to sell and pay his debts. Under the new ordinance, the rent reduction gives him an addition, $40.00—which he planned to spend, at least in part, on increased consumption of sugar, for sweetened condensed milk, and for some black cotton for a new year's outfit.

To help village people understand the tenure security program and its operation, the Vietnamese, with substantial American technical and financial assistance, prepared blank contract forms and publicity materials. Two million contract blanks were printed, each type with a different colored line drawing so that semiliterate peasants could readily distinguish among types. Posters were printed at a ratio of one for every 150 rural people. To identify the explanations with the proper contract forms, posters were color-keyed to match the line drawings. Leaflets were distributed on the basis of one for every three families.

As implementation began, an interesting paradox in landlord and tenant attitudes emerged. Much of Free Viet Nam had either recently been recovered from Communist control or Viet Minh forces still retained paramount influence. In these areas, particularly those in South Viet Nam, landlords had sometimes not collected rent for as long as eight years. Now, landlords looked upon the contract program as a means to assure them a rental of at least 25 per cent of the crop. On the other hand, tenants in these areas resisted the program since they had been paying no rent at all (although they had paid heavy Viet Minh taxes). By July 1955, however, the increasing stability achieved by the national government had changed the environment and more orthodox positions were taken by tenants and landlords, with peasants in favor and landlords protesting that rent rates were too low.

In addition, the program was plagued from the very beginning by administrative and enforcement problems. On the broader front, the government was still locked in a struggle with Communist subversion and rebellious armed sect groups. Administrative resources were scarce, and few men could be made available, even for so important a program as agrarian reform. When the ordinances were passed, the small General Directorate of Agrarian Reform in the Ministry of Agriculture struggled to put the new program into effect. In May 1955, during a general governmental reorganization, President Diem established a separate Ministry of Agrarian Reform to deal with the program and with agricultural

credit. But the combination of the lack of administrative manpower and the shifts in organization delayed real progress until mid-summer, well past the planting season. Provincial estimates of abandoned land were not returned until too late to assign tenants. The election of village and district agrarian reform committees had hardly begun when the original deadline had passed. Progress of the program was dependent upon the efforts of provincial administrations, which varied from complete co-operation to outright rejection of the whole concept. To support the administrative efforts, the U. S. Operations Mission assisted the Vietnamese government to secure 180 field agents. But organization was slow, and the government was unable to finish recruiting the agents until December. All told, the government used only $4,247 of American assistance through June 30, 1955 and $267,404 during the following fiscal year.

Although the agrarian reform program had been forseen as a partial solution to immediate problems, the impact during the 1955 season was small. Six months after the promulgation of Ordinance No. 7 there were only some 20,000 contracts registered. Of these, 16,200 were Type A for established tenants and 3,800 Types B and C for abandoned land. As information about the program spread and field agents began to reach tenants, the number of contracts climbed. By the end of 1955, nearly a year after promulgation, there were 277,345 contracts registered, 205,313 for established tenants and 72,032 for abandoned land. In another year, at the end of 1956, there were 537,030 contracts, 392,181 Type A and 144,849 Types B and C. This represents well over half of all tenants in Free Viet Nam, and some 3.7 million acres. Slightly more than 2.5 million individuals are directly affected. Approximately 1 million acres of abandoned land have been recultivated under registered contracts.

Most of this progress has been realized in the South where in some provinces four fifths of the tenants have contracts. In Central Viet Nam, only 95,120 contracts were registered, and only 17,243 Types B and C contracts reflecting the small amount of abandoned land in the crowded center. Other factors have also slowed down progress. The law limits rent to 25 per cent of the main crop, which is fitted to conditions in the one-crop South, but is not realistic in the two-crop coastal deltas. In the South landlords have much larger holdings, and do not link themselves closely to the village. In CVN, where holdings are small, the landlord is very much a part of communal life, and exerts a strong influence on tenant thinking. In these coastal deltas tenants are more concerned simply to find land to cultivate than they are in the more spacious South. For the tenant to raise the issue of a contract is likely to result in eviction with no alternative holding available.

Throughout the nation, problems of enforcement and administration

are still great. Although contracts clearly set the maximum rent at 25 per cent of the main crop, in practice most tenants with contracts seem to pay a third or slightly more of each rice crop. Even so, contract holders feel the program has been of distinct benefit to them, and point to neighbors without contracts who, now that stability has been restored, pay 50 per cent. The clauses relating to tenure security have proved difficult to enforce. Even though illegal eviction is a common complaint in the countryside, very few disputes have reached formal arbitration. At first the courts were unsympathetic to the program, but more recently tenants with contracts have won most of the disputes that they have appealed to the courts. Nevertheless, the high costs of legal action and the slow judicial process have combined to make recourse to the courts all but inaccessible to tenants. Only about half the villages have agrarian reform committees, and these meet infrequently and have often been irregularly appointed.

These problems of enforcement and administration are currently under review by the Department of Agrarian Reform, and it is anticipated the law will be amended to make it more applicable to conditions in Central Viet Nam and to simplify arbitration procedures. Consideration is being given to strengthening the agrarian reform committees and to giving them more power to settle disputes. The confusing sliding rent scale may be replaced by a single percentage of each crop, which in practice has already occurred, despite the theoretical disadvantages.

In general, the agrarian reform program in Free Viet Nam has made substantial progress toward accomplishing its goals, despite admitted shortcomings and problems. Tenants are aware of the program, are interested in it, feel the program can be a substantial benefit to them, and recognize in the program a concrete indication of government concern with peasant problems. More than half of the tenants hold valid tenancy contracts. The agrarian reform program directly affects the lives of more rural people than all other government agricultural programs combined. Some 1 million acres of abandoned land have been recultivated as a direct result of the program. In the countryside, there are strong indications that the government's agrarian reform program has reduced the appeal of Communist promises.

Enforcement and administration remain knotty problems that do not admit easy or quick solutions. To provide an adequate mechanism for settling disputes is probably the most pressing immediate problem. The courts are too expensive and overloaded to perform this service efficiently. At present it seems the solution will be sought by increasing the powers of local agrarian reform committees, with right of appeal to the provincial committee. Only broad questions of policy would fall within the

jurisdiction of the regular civil courts. There are difficult problems of mass education, of better training for poorly-paid agrarian reform agents, and of tightening of the lines of administrative control. The program still depends too much upon the attitude of the provincial chief, who can make the program a success or thwart it, depending on his personal opinion of its merits.

Implementation of the law has re-emphasized the necessity for an agrarian reform in an underdeveloped nation to be as simply framed as possible, even at the expense of fostering some inefficiency and injustice. The sliding rental scale has been nothing but a bone of contention, and probably will be replaced by a single, clearly stated rent rate, most likely 25 per cent. The necessity to tailor the law to fit differing regional conditions is brought out by the slow implementation in Central Viet Nam where the prevalence of double cropping and the pattern of tenure does not fit the provisions of the law. And finally, the difficulty of organizing and using local agrarian reform committees reflects at least in part the complicated, indirect election process. More direct election and a simpler statement of the powers of the committees would probably increase their effectiveness.

The agrarian reform has been an interesting example of the service that can be rendered by foreign technicians. From the very first, American advice and urging on the critical nature of the problem and on possible lines of remedial action played a critical role. The assistance of American technicians was important in helping to frame the decrees, and in helping to organize implementation. United States local currency aid was critical in supporting the administration of the program. Yet the Americans seem to have succeeded in retaining their position as advisers, not "operators," and there is no doubt the government rightly looks upon the program as its own, carried out with some American assistance. Peasants, it seems, identify the program entirely with the national government.

The whole program of rent reduction and tenure security has had a logical relationship to the better-known device of land transfer. In the first place, the tenure security program met a need at a time when the government could not have mustered either the political support or the administrative and financial resources to carry out land transfer. Secondly, the program is a necessary complement to a land transfer program, particularly since no current transfer proposal would have any appreciable effect on the tenure structure in Central Viet Nam, nor would it eliminate tenancy in the South. President Diem on October 22, 1956 announced a land transfer program framed in cooperation with American officials and unofficial advisers. But this program sets a reten-

tion limit of 250 acres, and best estimates indicate it would affect only about 270,000 holdings. Thus some three-fourths of Viet Nam's tenants would be unaffected by the new ordinance, although they will continue to benefit from the rent reduction and tenure security program.

Despite the problems they have faced, the Vietnamese have demonstrated yet again that a free nation can institute needed reforms by legal and just processes before deteriorating circumstances force the population to more drastic means. They have also demonstrated that foreign aid can be used to promote change without losing independence of action and control.

AGRICULTURAL ECONOMICS, PRODUCTION ECONOMICS AND THE FIELD OF FARM MANAGEMENT

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SINCE the interwar period, the relationship between the fields of agricultural economics, production economics and farm management has been under discussion. Early giant's of agricultural economics such as Taylor,[1] Black and Spillman saw rather clearly that economics had a considerable contribution to make to farm management and explained the need for this contribution with vigor. Agricultural economists were easily convinced. Actually, it might even be said that agricultural economists, deans and directors were overconvinced—at least agricultural economics attained such an administrative triumph over farm management in the land grant system that there is, at the present time, no separate department in the land grant system whose function is that of doing teaching, research and extension solely in the field of farm management.

Typically, the consolidation of farm management departments into agricultural economics departments preceded the development of a "production economics group" within a department of agricultural economics. These production economics groups, however, have developed rapidly and farm management is now tending to be defined as a subfield of production economics. Lest the reader think the author is "setting up a straw man," it is important to note that this definition of farm management is becoming institutionalized. In the USDA, for instance, there is an Agricultural Research Service. Within that service is PERB, the *Production Economics Research Branch,* and *within* that branch, one finds farm management.[2] Another example of the institutionalization of the definition is found in the awards contests of the American Farm Economics Association where there is a subcommittee on farm management and production economics. On the surface, it appears that farm management as a discipline is now well on the way to being dominated by production eco-

[1] Walter W. Wilcox, Sherman E. Johnson, and Stanley W. Warren, *Farm Management Research 1940-1941,* (Social Science Research Council: New York), pp. 5, 11.

[2] Fortunately PERB has recently been changed to FERD indicating that governmental alphabetical changes are not permanent.

nomics a subfield of economics and agricultural economists. This, it appears, would be unfortunate for both farm management and production economics. Management (including farm management) cannot be defined, abstractly or in practice, as *only* a subfield of economics. Still further, production economics has important contributions to make in other areas.

The Five Resistance Groups

One way of seeing some of the fundamental relationships among agricultural economics, farm management and production economics is to examine the strengths of groups who have been resisting, first, the domination of farm management by agricultural economists and, more recently, by production economists in particular. There are five such resistance groups.

The first group is made up of certain farm management extension personnel. Farm management extension men both in the United States and in the rather recently developed National Advisory Service in England have never swallowed the agricultural and production economics lines completely. They continue to place heavy reliance on information and systems of thinking from fields other than economics at the expense of not being able to employ fully all agricultural and production economic data and systems of analyses.

The second resistance group is the Society of Farm Managers and Rural Appraisers. One can search the publications of that society without finding much evidence of the triumph of production economics or, for that matter, of agricultural economics over farm management. The publications and meetings of that society cover subjects much broader than that of economics. In fact the subject matter ranges from technical material of an engineering, animal husbandry and agronomic nature, on one hand, to information on credit, taxation and social security on the other.

A third resistance group is made up of farm management professors of the earlier variety teaching mainly at the undergraduate level, though, in some cases, also at the graduate level. By and large, these professors are mature academic people who are not altogether convinced that they should "go over to agricultural and production economics" as far as the positions occupied by many agricultural economists, particularly those occupied by some of the younger men who are more highly trained in production economics and who are doing their applied work in the field of farm management. Many of the traditional professors have been successful. Their products have stood up well despite criticism from agricultural economists. Many are productive teachers who have earned reputations, over the years, of having a great deal to offer to students interested in the "management of farms." Many such professors now have in their classrooms some sons of former students who have been advised

by their fathers to take some courses from "Professor So an So," because somehow or another, "Professor So and So" contributed a great deal to their father's general education and ability to handle the problems of managing and operating farms.

A fourth resistance group is made up of a few agricultural economics departments which now, and prior to the general consolidation of farm management departments into agricultural economics departments, were primarily concerned with farm management. In some of these departments, the earlier forms of farm management have had enough political power to prevent them from being completely overwhelmed by general agricultural economics and, more recently, by production economics.

In recent years, a new and fifth resistance group has grown up in connection with the so-called farm and home development program or whole-farm-unit approach of the extension services. Serious thinking about the idea of farm and home development indicates that it is really a very broad management program involving the integration and attainment of the family and business goals of a farm family with the resources and technology at the disposal of that family. Where departments of agricultural economics have dominated farm management, or where the farm management groups have adhered to a rather strictly "economic" or business point of view, extension administrators have been almost universally reluctant to let either dominate a farm and home development program. Instead, extension administrators have insisted that farm and home development programs be broad, encompassing (as appropriate in solving the problems faced) agricultural engineering, agronomy, animal husbandry, human nutrition, homemaking, psychology, sociology and agricultural economics. Although, in the administrative practice of the extension service, the roles allotted to these disciplines often appear to be haphazard and somewhat inappropriate when the different state organizations are compared, noneconomic disciplines have probably played more important roles than general agricultural economists and production economists or farm management men would have suggested originally.

The common strength possessed by the resistance groups furnishes a concrete indication of the inadequacy of economics as a conceptual and empirical framework for farm management. Each resistance group tends to derive its strength from facts, concepts, theories and principles furnished by the noneconomic disciplines.

Agreement Between Current Managerial Thought and the Resistance Group

There is a basic similarity between the actions of the resistance groups discussed above and current thought concerning the managerial process.

This similarity indicates that theory and practice are in close agreement in many respects. Such consensus commands the attention of all who are concerned with the welfare of farm management as a discipline. In both instances, economics turns out to be a necessary but insufficient basis for management. In practice the resistance groups require noneconomic facts, theories and principles to operate successfully while, very similarly, those trying to conceptualize the managerial process find themselves drawing on logic (both deductive and inductive), the physical sciences, psychology, ethics, and sociology—to mention only a portion of the list. Neither static nor dynamic economics (whatever the last may be) are an adequate framework for management.

Academic thought on the managerial process has been a developing everchanging thing. Among a host of others, the very production economists who correctly argued hard a few years ago for a place in farm management for static production economics have continued their study of the managerial process. In the field of political science and public administration, workers are developing what is known as organization theory. In the fields of mathematics and statistics many are working on the theory of decision making while, in sociology and psychology, many are working on a field called human behavior. At Stanford University there is a Center for the Advanced Study of the Behavioral Sciences. In economics, managerial theory is evolving from risk and uncertainty theory, on one hand, and the theory of games, on the other. Home management specialists, too, are making their contributions as well, of course, as business administration specialists.

As the production economists doing applied work in farm management began to think about the management process, they drew heavily on Frank Knight's contributions in *Risk, Uncertainty, and Profits*. To a lesser extent, they drew on statistical theory and the theory of games. With this intellectual ancestry, a natural first tendency was to look at the different forms of imperfect knowledge. The question was: "What kinds of imperfect knowledge bother farm managers in a dynamic, everchanging world?" Introspection and examination of the managerial process as practiced by farmers revealed that managers are concerned with many types of information not commonly regarded as economic in nature. It was clear that institutional arrangements change repeatedly and that a successful manager keeps up with a flow of information on such things as income tax, social security, local taxation, production control programs and price supports. It was also clear that technological change plays a more important role than economists ordinarily assign to it. Also, as the changing behavior of people has impacts on the farm business, such changes make is necessary for the manager to gather and analyze information on people.

Once the range of information that managers use was thought out, a natural subsequent step for students of the managerial process was to examine the assumptions of the static production economic theory. Such examinations reveal the inadequacies of both static and dynamic economics as frameworks for the managerial disciplines. Many forms of static theory, it was found, assumed for a number of reasons[3] that technology is unchanging, that institutional arrangements are essentially static, that human behavior is predictable from constant, unchanging utility functions, and that managers have perfect knowledge of the present and future. A consequence of these assumptions is that prices are unchanging. Thus, it is clear that static production economics assumes away much of both the process and problems of management. It is no wonder that resistance groups were able to find a very real and important common ground on which to stand; namely, the inadequacies of static economics as a structural framework for management.

To date, no satisfactory classification has evolved for the problems farm managers face.[4] Static economics defines the problems of managing a farm as dealing essentially (1) with resource combinations, (2) with enterprise combinations and (3) with levels of input and, hence, of output. As the academician looks at the managerial process in operation on farms, he realizes that the list of problems solved by static economics is far too narrow. For instance, one of the most important problems faced by farmers is that of getting control over assets. A static economic theory which assumes the distribution of asset ownership is a very inadequate theory for a farm manager addressing himself to the problem of getting control over assets. Similarly, in our era of advancing industrial wage rates, the quest for new labor-saving technology goes on continuously and, again, principles and theories *that assume technology given* are not helpful when technology is a dependent variable under study. The failure of economic theory to provide an adequate list of classification of problems causes the academician to look still more deeply at the "problem of problems."

What is a problem? Study and examination of this question reveals that many problems are or can be stated as differences between a concept of "what ought to be" and a concept of "what is." Concepts of "what ought to be" are often referred to as values, goals and objectives. Concepts of "what is" are often referred to as facts. The study of value sys-

[3] These reasons include the desire to make efficiency and welfare comparisons which, in the absence of absolute interpersonally comparable utility measurements, are valid. This desire makes it necessary to assume away all changes not known to be Pareto better. Hence, changes in utility functions, asset ownership patterns, technology and institutions affecting rights and privileges tend to be precluded.

[4] Ernest Nesius, "The Role of An Agricultural Economist in a Farm and Home Development Program—from an Administrator's Viewpoint," *Journal of Farm Economics*, Vol. 37, December, 1955, pp. 844-5.

tems takes place largely in the group of disciplines referred to as the humanities while the pursuit of answers to questions of fact takes place in the sciences. Study of the problem of problems reveals that management is more than a science—the very problems on which farm managers work depend for their definition upon concepts of "what ought to be" and are studied in the humanities. Before realistic, long-range farm planning can be done, problems have to be defined. Goals and objectives need clarification and reconciliation with available resources. When a farmer looks at insurance problems and at problems of getting control over assets, a fundamental question is "How much security should a farm manager seek?" Another is "How should he balance his desire for security against his desire for control over more assets?" When a manager is choosing between two alternatives, statistical principles indicate that specifications for such choices should be based on the importance of being wrong if he selects the first alternative incorrectly versus selecting the second incorrectly. For example in choosing whether to buy a farm or not, the consequences of buying a farm when one should not are ordinarily much different from those of failing to buy when one should. Thus, it is clearly evident that philosophic value theory can make substantial contributions to the intellectual framework of the field of farm management.

When the economic scientist looks at the thought processes that farm managers employ, he is humbled about the contribution that he, as an economic scientist (either static or dynamic) can make to an understanding of the thought processes actually employed by managers in solving problems. Production economics, specialized as it is in answering questions about resource and enterprise combinations and levels of output, has only a modest contribution to make. Logic including statistics appears to have far more to offer than economics. Induction and deduction are thought processes employed day by day and hour by hour by managers.

Some may argue "Yes it is true that static economics is limited but how about dynamic economics? It appears to have enough breadth potentially, at least to handle all of the problems faced by managers." As dynamic economics is poorly developed at this point in time, it is hard to see clearly its eventual value in understanding managerial processes. When the question is asked, what does economic theory (either dynamic or static) have to offer to a farmer thinking out the economics of a dynamic problem in animal breeding or in building construction, we find that the theories of genetics or of physics are at least as important as the theories or principles of economics. About all that economic theory has to offer, it appears, in the process of solving engineering problems, is the basic economizing principle of matching added costs against added returns, under certain second-order conditions, as a basis for defining an

optimum. This principle is of use both (1) in solving the breeding or engineering problem, which may be either static or dynamic, and (2) in ascertaining, within the dynamic decision-making process, the optimum amount of information to acquire and the optimum amount of analyzing worth doing. Strangely enough, the same optimizing principle so basic in statics complements theoretical physics and genetics in solving dynamic engineering and breeding problems. Attempts to substitute economic theories and principles for the principles of physics and genetics in solving such problems would be foolhardy. Dynamic *economics* appears to be little better than static economics as an intellectual framework for management.

How Has Production Economics Fared?

The domination of farm management by general agricultural economics including production economics has not been entirely beneficial to farm management. Now, we ask, how about production economics? It is reaching its full potential as a result of having been identified with farm management to the extent that the terms "farm management" and "production economics" are used jointly or interchangeably in the following:
(1) the organization of
(a) many land grant colleges and universities
(b) the U.S. Department of Agriculture
(c) in the committee structure of the American Farm Economics Association and
(2) the thinking of a high proportion of general agricultural economists?
The answer appears to be an emphatic "no" on the following counts:
(1) Partially as a result of the identification of production economics with farm management, marketing personnel in both colleges and the USDA have neglected the application of production economics. The seriousness of this neglect is attested by the splendid progress made by marketing personnel at the University of California where a rather intensive effort has been made to apply production economics to marketing. Marketing, like farm management ten or fifteen years ago, needs among many things a sizeable but not dominating injection of production economics.
(2) Also, partially as a result of the identification of production economics with farm management, policy students, although often basically well-trained in production economics, have failed to use production economics to produce crucial estimates of aggregate supply functions. Instead, they look to the production economists working in the field of farm management (whose hands are full

with important farm management work) to produce such esti-
mates.[5]

(3) Land economics, it appears, is also being deterred from making full
use of production economics by the identification of production
economics with farm management. The overlap between farm
management and land economics is such that conflicts can easily
arise between the two areas.[6] In such situations, the identification
of production economics with one tends to preclude its use in the
other.

Implications of the Above Argument

The implications of the argument presented in this paper are broad
indeed. The following conclusions are presented:

(1) The land grant system has made a mistake in permitting agricul-
tural economics to dominate farm management.
(2) Production economics, as a subfield of agricultural economics, is
not in position to give complete intellectual guidance to the field
of farm management.

This paper does not imply that:

(1) The traditional forms of farm management were capable of bring-
ing out the full potential of the discipline.
(2) The land grant system would be better off with its former farm
management organization than it is at the present time. This is to
say that the earlier farm management organization also had its
shortcomings, one but not all of which could be remedied by using
more economics.

The resistance groups[7] and earlier farm management departments did
not have the organized interdisciplinary breadth required to support
the increasingly broad concept of management. Typically the earlier
farm management departments emphasized technical agricultural sci-
ences without giving adequate attention to the social sciences (including
economics) and the humanities. Still more important, they were some-
times highly inductive and empirical. For this reason they did not always
use enough theory and principles from any science, including the physical
sciences, economics, other social sciences and the humanities. The sur-
vival ability of the pockets of resistance to the onslaught of an unduly
specialized approach to farm management does not indicate that the
earlier approach was ideal or that it had sufficient breadth.

[5] See for instance Willard W. Cochrane, "Agricultural Economics in the Decade
Ahead," *Journal of Farm Economics*, Vol. 36, December, 1954, pp. 822-23.
[6] Michigan State University, fortunately is an exception to this generality.
[7] The farm and home development idea has the potential breadth but, as yet,
has not found adequate organizational expression.

Before looking constructively at the future of farm management in the land grant system, a kind word or two should be said for agricultural economists and, more specifically, production economists. The agricultural economists and, later, the production economists who introduced additional economics into farm management are to be commended for their contribution. Economics, particularly production economics, had a badly needed contribution to make. We must, however, be cautious in our praise. To the extent that the process of introducing economics pulled farm management out of or away from the agricultural technical sciences instead of adding to it, the discipline of farm management has been harmed as well as benefited.

When one looks to the future of farm management, he sees a subject almost unmasterfully broad. Several other disciplines from both the sciences and the humanities also have much needed, important contributions to make to farm management which cannot be made by anything one could reasonably call dynamic economics. These other disciplines include statistics, logic, sociology, home economics, psychology, philosophic value theory as well as the physical and biological sciences. In this connection managerial thinking still has rough days ahead—it still has to absorb the contributions of the other social sciences and the humanities *without* becoming dominated by any of them. Perhaps farm management, involving as it does both the sciences and the humanities, is an impossible academic discipline. Is it possible for professional farm managers to secure enough training in the range of disciplines running from soil chemistry and physics on one hand, through economics and the social sciences to ethics, on the other, to operate in a multiplicity of farm situations? Although thousands of actual farm managers succeed in doing this, each of them is dealing with a specific, individual situation. The academic farm management men face a much more difficult task. They must be prepared to operate in many different farm situations. At the present time, the author knows of no academic, research or extension service farm manager who meets the test of being able to operate across the board from the details of science to ethics in any farm situation. The same is true of personnel in farm management firms. These people, too, display a tendency to be specialized by geographic areas and by type of farm as well as by academic disciplines.

This present unsatisfactory situation is not without promise, however. Much work is being done on many phases of management in many disciplines. In the extension service, the farm and home development program makes slow painful progress. The roles of the various disciplines in management are certainly clearer than they were fifteen years ago. Yes, even clearer than they were five years, two years, or even a year ago.

Progress is occurring in the form of a willingness to let all disciplines contribute to our understanding of the managerial process without dominating it.

Among other "nasty questions" about the future of farm management are these two: Would it be possible to administer departments of farm management that must master such a wide subject matter? Is it possible, if such departments could be administered internally, for them to exist side by side with the other departments of agronomy, animal husbandry, economics, crops, philosophy, sociology, home management and human nutrition, which would necessarily have to nurture such a department? The problem is indeed a grave one. Perhaps farm management is a subject for the dean's office or the experiment station administrator's office instead of a basis for a department or a section of a department. Perhaps, instead, it is only a "point of view," which, while properly held by all agricultural educators, is unduly restricted by being consigned to any portion of an administrative structure. Although the answer is far from clear today, two facts are worth remembering: (1) The survival rate among independent farm management departments has not been very encouraging. (2) The tendency to narrow farm management to a subpart of agricultural and production economics, when it is a subsection of a department of agricultural economics, is not entirely beneficial to either farm management or production economics.

FARMER DEBTOR RELIEF: A CASE STUDY

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> —But the virtue of paying your debts is incompatible with an absence of money.—A. TROLLOPE

CONFLICTING economic interests can be regulated by the law which serves to allocate and delineate respective rights and obligations of the individuals, or groups of individuals, whose interests are in conflict. The following discussion of farmer debtor relief legislation brings into focus such an area of conflict. The purpose of this article is to determine whether the legislation has striven to achieve a proper balance between the conflicting interests of farmer-debtors, of their creditors and of society.

The Conflicting Interests

When farmers become delinquent in their payments, creditors are authorized by law to enforce their claims (e.g. through foreclosure) regardless of the cause of the distress, even if such action threatens to deprive farmers of their farms and homes. Under those circumstances, the individual farmer's aim to rehabilitate himself and to preserve his status stands in direct conflict with the creditor's aim to preserve his investment and his rights. If distress is widespread, the welfare of local farm communities or of society as a whole, and the respect for law and law enforcement, must also be considered.

Were we to respect exclusively the economic interests of distressed farmers, we could simply limit the right of creditors to enforce their claims, as was done, in part, through state moratoria during the 1930's. But, obviously, to curtail creditors' rights on a permanent basis would sharply increase their economic risks and could endanger agricultural credit and consequently the growth of agriculture. Also, if distressed farmers were permitted to remain on their farms irrespective of their managerial ability or the adequacy of their farms, they would become obstacles to needed adjustments to a changing economic environment.

The objectives of farmer-debtor relief, therefore, should be (1) to permit farmers who wish to remain on their farms to withstand prolonged periods of financial distress; (2) to enable them to adjust their financial situations to the distress conditions without causing severe harm to the credit structure or without creating obstacles to increased efficiency in

agriculture; and (3) to prevent or reduce mass foreclosures or farm bankruptcies.

Legislative Background

In order to effectuate a solution, the legislator must evaluate the extent to which he wishes to protect or abridge debtors' and lenders' rights. This was attempted for the first time in the *Frazier-Lemke Act* (1933), i.e. *Section 75* of the U. S. Bankruptcy Act, which gave widespread federal protection to farmers. It provided in brief that a farmer could ask for a moratorium of three years, after which he could "redeem" his farm at an appraised value.[1] In essence, this act authorized a farmer to block the creditor's right to foreclose if he was able to obtain new funds for the redemption. This act enabled the petitioning farmer to *adjust* his debt situation to prevailing depressed conditions through the redemption procedure.

Several years before the expiration of Section 75 (1949), and every year since, permanent legislation in the form of a new Bankruptcy Act "Chapter XVI: Farmer Debtor Relief" was proposed to replace temporary Section 75.

Until 1952, a number of nearly identical bills were passed by the Senate that incorporated the principles and experiences of the Frazier-Lemke Act without some of the latter's obvious shortcomings. The bills were based on proposals made by a group of bankruptcy experts. Since these bills all contain the possibility of a debt adjustment, further reference to them will be made collectively as the *"Debt Adjustment Bill."* The Debt Adjustment Bill[2] authorizes a farmer to petition the federal courts for a moratorium of up to three years which is granted immediately upon approval of his petition. Henceforth, the farmer's property will be appraised at its "then fair and reasonable market value." During the three years, the farmer can either offer to his creditors a "plan," i.e. a composition or extension agreement (a voluntary, mutually satisfactory debt adjustment as to amount and repayment time of the debts); or, if the offer is not accepted, or if the farmer has made no offer, he can "redeem" the property at the appraised or reappraised value. An additional moratorium of two years can be granted if the farmer has paid half of the appraised value before expiration of the first term. The provisions of this lengthy bill are modeled closely upon provisions of chapters of the bankruptcy laws which afford relief to other groups of debtors.

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[1] See also E. Feder, "Farmer-Debtor Relief Legislation in the U.S. and in Switzerland," *Journal of Farm Economics,* May 1952, pp. 229 f.

[2] See also: *Journal of Farm Economics,* May 1952, pp. 231-232. For an excellent, detailed analysis of this proposal, see: Editorial, *Yale Law Journal,* Vol. 56 (1947), pp. 982 ff.

Since the 82nd Congress, however, the Debt Adjustment Bill has been abandoned in favor of a different proposal designed to do away with the redemption and oriented toward a federal judicial moratorium as the major method of farm relief. This proposal is the object of more detailed comments below and represents, upon close examination, a shift toward less protection for farmers and greater protection for lenders. The proposal was contained in a number of bills which, with one exception, were identical. They were introduced in the 82nd, 83d, and 84th Congresses, and will be referred to collectively as *"the Moratorium Bill."* In the 83d and 84th Congresses, this Moratorium Bill was passed by the Senate—last on July 12, 1956, without any discussion.[3] Hearings were held on the corresponding House bill[4]—introduced by Representative Hillings (California)—before the House Committee on the Judiciary on February 17, 1956, but it was not reported out of the committee. Significant for the rush in which bills are often handled in Congress was the introduction, also by Hillings, just prior to the scheduled hearings, of a new bill[5] that differs in some important details. Reference to it will be made as the *New Moratorium Bill*. Most witnesses at the hearings did not have time to study and testify upon the newer bill, and should it replace the former in the House, the February hearings will have provided inadequate analysis of its provisions.

Since no new bill has as yet been passed by Congress, there is no legal reason why Section 75—even though it expired in March 1949—could not be revived by simply extending the date of expiration.[6]

Appraisal of the Moratorium Bill

All bankruptcy procedures use debt adjustment (scale-down) as one major alternative for achieving relief. Bankruptcy, which relies on the *liquidation* of assets alone, is a forced scale-down and amounts to an impairment of obligations of debtors to creditors. Procedures that propose the debtor's *rehabilitation*—a new objective introduced into bankruptcy legislation in the 1930's—also include debt adjustment as one of the (major) alternatives. From this concept, the Moratorium Bill presents a departure for which agricultural economists may have been responsible. This bill was undoubtedly inspired by the publication "Improving Land

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[3] S. 689, 84th Congress, 1st Session.

[4] H. R. 670, 84th Congress, 1st Session. For a detailed analysis of this bill, see Ernest Feder, "What Kind of Bankruptcy Legislation for Farmers?" *Nebraska Law Review*, November 1955, pp. 39 ff.

[5] H. R. 9267, 84th Congress, 2nd Session.

[6] Indeed, in early 1955, Senator Watkins introduced such a bill (S.316) but no action was taken and it was not mentioned on the floor of the Senate when the Moratorium Bill was passed.

Credit Arrangements in the Midwest,"[7] containing proposals made merely as "tentative suggestions needing further examination to show whether in the balance their merits outweigh their demerits":

". . . (b) An amendment to the National Bankruptcy Act would probably be the simplest and most effective way to provide for a stay of foreclosure proceedings under certain specified conditions. . . . It should include these essential provisions:

(1) Protect the *full amount* of the lender's claim, but provide for *time-flexibility* of principal and interest payments under clearly stipulated conditions.

(2) Establish criteria which should make a delinquent borrower eligible for deferment or extension privileges.

(3) Prescribe an equitable procedure by which borrower and lender can work out a payment schedule geared to the borrower's ability to pay, until the mortgage loan is again in good standing.

(4) The full amount of delinquency should be added to the unpaid principal and carry the same interest rate, without penalty charge. There should be no maximum time limit for the duration of such deferred payment schedule. Once a year, however, both parties should have the right to ask for a reexamination and possible revision of the payment schedule."

These proposals were taken over *in toto* by the drafters of the Moratorium Bill. They, and the major provisions of the Bill incorporating them, will now be examined in the light of three criteria: (a) other provisions of federal bankruptcy legislation, (b) the provisions of the Debt Adjustment Bill,[8] and particularly (c) the impact of the Frazier-Lemke Act, as revealed by a recent "law-in-action" *case study*.[9] The probable effects of the Bill on farmers, lenders and society will be outlined, and alternative methods proposed.

The Bill's roadblocks to the use of the relief procedure

(1) A distressed farmer[10] can start a relief procedure by filing a petition and by submitting a statement of his financial position and an offer of rental payments. Both owners and tenants can take advantage of the law,

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[7] *North Central Regional Publication 19*, Purdue University, Agricultural Experiment Station Bulletin 551, June 1950, pp. 23-24.

[8] Space permits only summary comments on general bankruptcy legislation or the Debt Adjustment Bill, since detailed analyses would require reference to their exact wording and meaning.

[9] J. A. Munger and Ernest Feder, *The Frazier-Lemke Act: Its Impact on Farmers and Lenders, Particularly in the Northern Great Plains*, ARS 43-43, U.S.D.A., Washington, D.C., January 1957. This report is based on a detailed analysis of Frazier-Lemke cases in the Dakotas and Nebraska and attempts to evaluate the extent to which the Act assisted farmers in withstanding the depression and the losses that farmers and creditors suffered as a result.

[10] A farmer is in financial distress, in the meaning of the law, if he is insolvent or unable to pay his debts as they mature, regardless of whether or not his debts exceed his assets.

but the provisions with respect to tennants are not clear and probably exclude sharecroppers and the like.[11]

The New Moratorium Bill further denies the use of the law to farmers who have lost their farms at a forced sale other than a tax sale and have only a right of redemption left. This limitation probably narrows the application to farmers alert enough to go to court at the first threat of foreclosure, but it may have a more serious drawback by threatening unequal treatment of farmers as a result of variations in state laws on redemption rights in foreclosures.

(2) In offering rental payments, the farmer must take into account the farm's market value, its customary rental value, the net income and earning capacity and "other factors." Notwithstanding reference to market value, no provisions exist with respect to an appraisal—a serious deficiency that would put farmers in an unfavorable position throughout the procedure.[12] A farmer may encounter considerable difficulties in determining a fair and reasonable rental without a reliable estimate of the market value of the farm, even if he hires an appraiser at his own expense.

What are the reasons for abandoning the appraisal procedure? Under Section 75, the appraisal was intimately connected with the redemption of the debtor's farm at its appraised value. The appraisal-redemption feature has been vigorously attacked by lending institutions as not protecting, in actual practice, the interest of secured creditors. This argument deserves examination. Legally creditors are not entitled to more than the value of the security,[13] and the appraisal is a step in securing an estimate of this value. Section 75 also provided for reappraisal of the farm at the time of the redemption, for the lender's and the borrower's pro-

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[11] The Debt Adjustment Bill makes no distinction between ordinary tenants and sharecroppers, and there is no reason why the latter should be denied the benefits of relief.

[12] See also: Fred H. Kruse, "Reestablishing the Availability of Farmer-Debtor Relief under the Bankruptcy Act," *Minnesota Law Review*, Vol. 39, 1955, pp. 735 ff.; and his statement in Hearings of Subcommittee No. 4 of the Committee on the Judiciary, House of Representatives, on H. R. 670, February 17, 1956, (typed), p. 26. Section 988 of *H.R. 9267* states: "If written objections [to an extension proposal by the farmer] are filed by any unsecured creditor, they shall be heard and *evidence may be taken on the value* of the equity, over and above liens, in property the debtor seeks to redeem . . ." What kind of evidence other than appraisals can be used in a serious determination of this value?

The Debt Adjustment Bill is considerably more favorable for the petitioners. It provides for an appraisal of the property by court-appointed appraisers; and the *court,* and not the farmer, fixes the rentals. The court can consider the farmer's "ability to pay" in fixing rentals. If circumstances justify it, the rentals can be increased or decreased. The court must take into account the creditors' interests and the farmer's ability to pay in view of his rehabilitation.

[13] If the security is inadequate to satisfy the claim, the secured creditor could sue the debtor on his note for the remainder. This is, of course, not practical at a time when farmers' assets generally are inadequate to cover their debts.

tection. This legislation was passed, of course, when farm property was generally inadequate security for secured loans. Whenever the appraised market value of the security fell below the full amount of the secured claim, as it usually did, a redemption resulted in a scale-down. But if the appraisal is arrived at honestly, the interests of secured creditors would appear to be protected.

In the Northern Great Plains Frazier-Lemke case study there was no evidence that redemption values tended to fall below market values. On the contrary, during the 1930's, since neither buyers nor sellers knew what farms were worth, one may conclude that farm appraisals tended to introduce an inflationary element into the land market. With few exceptions, reappraisals usually benefited creditors.[14]

The appraisal-redemption procedure *was* harmful to creditors in that their right to foreclose was set aside, but during the depression this right was of doubtful value. The case study shows that creditors, on the whole, lost money regardless of foreclosure or redemption, even though some foreclosing creditors may have gained by hanging on to their farm until land prices had increased.[15] Therefore, a "successful" foreclosure often amounted to a self-imposed scale-down for the creditors. Section 75 probably raised creditors' losses not much above those that they would have suffered anyway. The statement that appraisal-redemption provisions do not protect the interests of secured creditors can only be interpreted as opposition to any measure that would interfere with the creditors' absolute right to foreclose.

(3) Unlike any other existing or proposed bankruptcy procedure, the first *"creditors' meeting"* is of crucial importance in the Moratorium Bill. Besides business matters pertaining to financial arrangements, the fate of the petition is decided there and then, following the determination of the *cause of the debtor's distress*. (This corresponds to the Tenure Committee's proposal to determine whether the delinquent borrower is "eligible for deferment or extension privileges.") On this cause depends whether or not the farmer will be granted relief. Farmers unworthy of relief are those whose distress is caused by "causes within their control" (bad personal habits, failure to attend to business, diverting farm income to non-agricultural expenditures and extravagant operations). Worthy farmers are those whose financial difficulties are caused by national emergencies,

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[14] Munger and Feder, *op. cit.* pp. 45f.

[15] But losses in redemption cases exceeded losses in cases where farmers made unsuccessful attempts to redeem and were foreclosed. The comparison is only approximate as data for more accurate evaluation were not available. Creditors who can afford to wait will attempt to sell foreclosed property at a price equal to their investment, while in the redemption procedure the redemption "price" has no relation to the creditors' claims.

declines in the agricultural market, acreage reductions under the law as a result of which the farmer cannot operate at a normal profit, and local emergencies such as drought or frost.[16]

The granting of relief in accordance with the petitioners' character seems undesirable. First the determination of a farmer's worthiness at the creditors' meeting puts the farmer at a bargaining disadvantage. In other bankruptcy procedures, the presumption is that the bankrupt is honest and worthy of the protection of the law. In the Moratorium Bill he is presumed unworthy. The provision brings into the procedure a highly subjective note—rumors, the personal relationship between the debtor and his neighbors or his creditors against which the bill provides no means of defense—instead of making relief dependent upon the simple fact of financial distress. Farmers would hesitate to submit themselves to what may turn out to be recrimination.[17] Also under the ordinary rules of business, worthiness is judged at the time of the extension of a loan, not when the farmer is in financial straits.

There is no evidence that farmers are less trustworthy and honest than non-farmers. Bankers, conciliation commissioners, and others stated that even under the old Section 75 farmers did not take "undue advantage" of the law, and bankers showed no ill feeling against their patrons for having made use of the Act. Occasional fraudulent farmers were taken care of in the appropriate manner by the courts.[18]

The provisions with respect to causes beyond the farmers' control are also difficult to interpret or apply. First, the meaning and the declaration or determination of "national emergency": even if the concept were extended to include economic emergencies,[19] how would a federal court go about defining it? Would an agricultural depression alone be a national emergency? Could not one court declare or determine it and an-

[16] Here the wording of *H.R. 670* is different from *H.R. 9267*. See text below.

[17] Creditors often do not know much about the character of their borrowers. See for example: "Bank Financing of Dairy Farmers in Northern Vermont," Agricultural Information Bulletin No. 129, USDA, ARS, Washington, D.C., May 1954, p. 33. Hence, reliance on secondhand information may predominate the determination of the farmer's worthiness.

[18] To accord "relief" only to worthy farmers is apparently based on an erroneous interpretation of the concept of relief. In the case of "relief payments" from public funds (e.g. unemployment compensation, welfare contributions) the distinction between worthy and unworthy recipients may be justified, but it seems out of place in the context of bankruptcy.

[19] Brown v. Bernstein: ". . . Congress throughout the years made little or no distinction between a state of national emergency and a state of war." 49 F.S. 732. Fred H. Kruse, *op. cit.*, p. 739, states that federal courts have never held that the "emergency ceased to exist locally" though section 75 authorized the courts to do so and though farm prosperity had returned. However the language of s.75 s(6) was faulty and the Moratorium Bill raises somewhat different problems than s.75.

other court deny its existence? Also, why would a court, rather than the President of the United States or Congress, declare or determine a national emergency? Would it not hesitate for fear of causing increased anxiety? In its present form, the bill poses unanswerable questions.

Secondly, in the bill's restrictive language (if a farmer's distress consists of a failure to operate with normal profits as a result of a depression and the court decides that there is no "national emergency"), the farmer may be unable to obtain relief since relief depends upon the decision as to national emergency rather than upon the individual's distress. The New Moratorium Bill provides: ". . . causes . . . shall include, *but not be limited to*, national emergencies" and may afford relief to farmers during periods of economic distress other than "national emergencies." This does not necessarily obliterate the problem, however, because in later sections reference is made to "emergency" as an apparently exclusive cause of the petitioner's distress.

A real obstacle is the discrepancy between the wording of the Moratorium Bill and the "intent" of its supporters. The bill's *terms* imply that relief can be obtained by farmers in depressions resembling emergency situations, e.g. depressions similar to the 1920's or 1930's. This stands in contrast to the meaning the bill's supporters wish to attach to it. Senator Magnuson stated in the Senate that he did "not think the bill would meet a national emergency." This obvious contradiction introduces an element of deception. This would create difficulties of interpretation by the courts.

The limitations of the unlimited moratorium

(1) The Tenure Committee's proposal that "there should be no maximum time limit for the duration of such a deferred payment schedule" has been incorporated into the Moratorium Bill in the form of a judicial *"unlimited moratorium,* which is granted the "worthy" farmer, as the first and major form of relief, "for the duration of the emergency without expressly limiting the moratorium to a term of years." At the request of a creditor, new hearings on whether or not the emergency continues may be held at intervals of two years, or, after the moratorium has lasted four years, at one-year intervals. Farmers cannot request a hearing except that they may appeal a decision of the court that the emergency has *ceased* to exist.[20]

The New Moratorium Bill is more restrictive. At a new hearing, not only can the question of the emergency be re-examined, but also whether or not the debtor's distress is, *at that time,* due to causes within his control. The

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[20] In the Debt Adjustment Bill, once the farmer's petition has been approved by the court, the moratorium is mandatory. The granting of the petition is subject to evidence that the farmer is insolvent and other provisions laid down by the law.

emergency is deemed to have ceased with respect to the petitioner if:

". . . although the debtor's distress originally was due to a cause that affected the majority of farmers in the immediate community in which the debtor's farm is located, his continued distress is due to a cause which does not then affect other farmers in the immediate community in which the farm is located and from which distress the debtor has not made reasonable efforts to relieve himself." (Section 942.)

The underlying idea of this clause is that the petitioner must be on his "best behavior" during the moratorium. Thus the personal character traits of the petitioner, satisfactory at the beginning, are assumed to be subject to deterioration, probably under the impact of the distress. A new criterion is introduced into the determination of the farmer's worthiness at this point (a "cause of distress which affects the majority of farmers in the immediate community—" which may or may not mean that the majority of the farmers are also in distress) in addition to the criteria used in the determination of the farmer's worthiness at the creditors' meeting. There, reference is made only to the results of the causes on the farmer-debtor as an individual. Hence if a farmer has been granted a moratorium as a result of local or regional drought, which has affected the majority of farmers in his community, but his own finances *remain* distressed without the majority of farmers in the immediate community sharing in this continued distress (for instance, his crop has now been destroyed by hail); or because his financial distress is more serious due to initially larger debts (for instance, he is a beginning farmer), the court must declare the moratorium at an end.[21]

A further hardship for farmers is that *any* creditor, secured or unsecured and regardless of the size of his claim, may appeal the court's decision that the emergency continues to exist. In fact, nowhere are there any provisions, as in other chapters of the Bankruptcy Act, that divide creditors into classes according to the importance or nature of their claims. This may put a farmer at the mercy of a small but unrelenting creditor— a situation Section 75 already attempted to overcome.

(2) If during the moratorium the farmer defaults in the payment of rentals and this default is not cured within sixty days, the court may end the proceeding. This is one of the harshest provisions. It is contrary to the express purpose of giving a farmer an unlimited moratorium if he is deserving of it. It gives the court no alternative.[22] In a period of prolonged drought or gradually decreasing farm incomes, the Moratorium Bill would be of little value to many petitioning farmers.

[21] For other examples of poor draftmanship, see: Hearings, *op. cit.,* pp. 40 ff.
[22] In the Debt Adjustment Bill the court may give due consideration to the circumstances of the case and may alter the conditions of the payment of rentals.

The "extension": A free-for-all?

Let us now turn to the main feature of the Moratorium Bill, the attempted "protection of the full amount of the lender's claims."

(1) Within a period of sixty days following the end of the moratorium, a farmer may "file . . . a notice of election wherein he may elect an extension."[23] If he does, he must propose:

". . . the full payment of his *secured* claims amortized over a term of years . . . not exceeding the greater of ten years of the original term of years . . . and such extension proposal shall provide for payment of *unsecured* debts . . . to the extent and on the terms which the debtor believes he will have the ability to pay from his future income."

For nearly four years neither drafters nor supporters of the bill were aware of the incorrect language used in this rather unique provision. Extension, by its very definition, cannot also mean composition, and obviously the above "extension" proposal may also include a proposal for a composition of unsecured debts.[24] Whether this terminology was used in order to "hide" the fact that the no-scale-down-principle had not been fully adhered to or through mere oversight is not known.

The Moratorium Bill establishes a treatment of secured debts radically different from that of unsecured debts. By providing for full protection of the former, but not for the latter, it discriminates in favor of secured creditors. In actual relief procedures, the two groups of creditors may be fighting each other, as well as the farmer in distress. Unsecured creditors may conspire toward making the farmer appear unworthy of relief, or they may press toward a speedy termination of the moratorium even though secured creditors may look upon a prolonged moratorium with relative equanimity. For modern farmers whose unsecured claims for fuel, seed, or fertilizer are large, the section could make it impossible to obtain effective relief.[25]

Unfavorable for the petitioner also are that the adjusted unsecured debts must be paid back "out of the future income of the farm" so that a farmer cannot redeem his old debts by securing new funds,[26] and that the farmer *must* accept an extension proposal which has been *modified* following objections (to his original proposal) by a creditor, whereas the

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[23] One witness pointed to a further serious gap in H. R. 670: it does not specify the rights and duties of the petitioner and the creditors during this 60-day period. Hearings, *op. cit.*, p. 44. Also the terms "election" and "elect" are misleading since the farmer has no alternative relief if he does not "elect" the "extension."

[24] The error has been corrected in H. R. 9267, the New Moratorium Bill.

[25] The Debt Adjustment Bill contains detailed and carefully worked out sections on the financial adjustment to be accorded the debtor, and affords creditors and farmers greater protection than the vague provisions of the Moratorium Bill.

[26] H.R. 9267 omits this requirement.

farmer may feel that he cannot rehabilitate himself under the modified proposal.[27]

The discriminatory treatment in favor of secured creditors assumes additional interest because the Tenure Committee had argued originally that ". . . a nationwide farm mortgage foreclosure moratorium . . . probably would make private lenders a little more cautious, but not unduly so, if their total claim remains unimpaired."[28] More pointedly, the supporters of the Moratorium Bill claim that a scale-down, such as in the Debt Adjustment Bill, would "dry up credit to farmers" and thus hurt them. But this argument could be taken more seriously if the drafters of the Moratorium Bill had not assumed, by the same token, that a scale down on *unsecured* debts would *not* hurt farmers by drying up sources of unsecured debts.

Can a scale down on secured loans affect agricultural credit? Were Congress to pass the Debt Adjustment Bill, institutional lenders might adopt a policy of restricting their lending activities. During the 1940's, however, secured farm loans increased rapidly, even though the Frazier-Lemke Act was in force. It would be difficult to maintain that these loans would have increased more had the Act not been in existence. Again, after 1949 lenders did not rush into the farm lending field because Section 75 had expired. If lenders became more selective in making loans, this must be attributed to their disastrous experiences of the depression.[29] Against the adoption of such policies also is the experience of non-agricultural borrowers who, when insolvent, would benefit from various chapters of the Bankruptcy Act providing for scale downs.

If one agrees with the "drying-up-credit" argument the scale-down provision for unsecured creditors may hurt farmers as much as that for secured creditors. Lenders of operating funds would then become cautious and advance no funds without chattel mortages—a policy that would greatly hinder the operation of a farm business.[30]

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[27] The Debt Adjustment Bill is more equitable and stipulates, *inter alias*, that the proposed "plan" as finally approved by the court should result in the financial rehabilitation of the farmer.

[28] *Op. cit.*, p. 25. Whether the Tenure Committee intended its proposal of the protection of the full amount of claims only for mortgage-secured real estate debts is not clear, but would seem to be implied from proposal (3) quoted above.

[29] Life insurance companies have now invested $2 billion in agricultural, as against $24 billion in nonagricultural, mortgages. *Life Insurance Fact Book*, 1956, p. 77.

[30] The 1955 Nebraska legislature discussed, but did not pass, bills proposing *liens* in favor of oil, and other, companies *on crops produced with the gas, oil,* etc. sold by them. Here the recognition of the growing importance of operating funds— advanced without securities—and the drought were the motives for introducing these bills, not the threat of scale-down laws. In 1956, oil companies were reluctant to extend credit, many farmers being delinquent on their fuel bills. Of course, if one

The combined effects of the moratorium and extension provisions seem discriminatory in favor of lenders with powerful financial resources. Small private lenders, commercial banks and rural business firms may be more interested in settling rapidly with their debtors, even at a loss, than in riding out a prolonged moratorium. By denying farmers the composition arrangement for secured debts, a depression may be intensified in the nonagricultural sectors of the economy. In the Frazier-Lemke case study, the apparent large losses of creditors secured by nonreal estate, even after a moratorium of only three years, were significant. In most cases the security had already lost its meaning, and in no case was there any mention of the redemption of secured property other than real estate. In conclusion, secured creditors may be much more opposed to a long moratorium and extension than is indicated by the statements of large institutional lenders in favor of the Moratorium Bill.

(2) The facts on which the Tenure Committee based its tentative proposals excluding scale-down provisions similar to Section 75 can be used as arguments in favor of scale-down provisions.

(a) Under the impact of the depression, debt adjustments did take place on a large scale. Voluntary scale downs involved untold millions of dollars and occurred even where and when creditors held the unabridged right to foreclose. Their ultimate objective or result was rehabilitation of the farmers and often the minimizing of lenders' losses. The Farm Security Administration, for instance, assisted in reducing debts of $505 million by 22 percent between 1935 and 1943. The total debt reduction throughout the depression may have exceeded the billion dollar mark. The need for scale down was apparent. In nine Northern Great Plains counties, liabilities exceeded assets in 82 percent of the 288 Frazier-Lemke petitions. The petitioners were by no means the farmers who were the worst off, but those who still had enough interest in their farms to hang on to them. In most instances, real estate debts were higher than the value of the original mortgage, indicating the farmers' loss in equity.

But continued mass foreclosures in the farm states and the reports on conciliation and debt adjustment activities point toward the relatively small success of voluntary debt adjustments. Creditors were generally adamant in collecting their debts—as confirmed in interviews with farmers and conciliation commissioners.[31] Therefore the alternatives to be weighed

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admits that a scale-down law can dry up credit, one should expect an avalanche of bills, such as Nebraska's, to be passed by state legislatures, regardless of economic or climatic conditions.

[31] The Tenure Committee (*op. cit.*, 19-20) points to the inadequacy of a moratorium when it states: "The judicious use of extensions, deferments, and reamortizations could solve many delinquent mortgage situations. With these tools, a financially sound lender with the borrower's interest at heart can handle many delinquency problems that are likely to arise in the future." If a lender wants to remain in sound financial

are not "debt adjustment versus moratorium," but "debt adjustment through economic pressure versus debt adjustment through legal procedure." The legislator should recognize the need for debt adjustment by setting up adequate channels for carrying them out when the need arises instead of sidestepping the problem.

(b) In favor of scale downs as a major alternative method of relief is the need for the farmers' rehabilitation and the fact that a moratorium alone cannot always achieve this objective, which is recognized as a leading element in modern bankruptcy law. Farmers are subject to financial risks as high as, or higher than, nonfarmers and are usually unable to build up adequate reserves for contingencies. Why should farmers be denied relief granted nonfarmers under various chapters of the bankruptcy laws? If rehabilitation means readjustment of a farmer's financial position to prevailing economic and weather conditions through a scale down, courts should be authorized to give him the scale down.

This seems to be confirmed by the fact that in nine counties in the Dakotas and Nebraska the indebtedness on real estate at the time of the petition (usually the time at which a farmer was being foreclosed) exceeded the *original* mortgages by 8 percent. Hence, a high proportion of the indebtedness was due to accumulated unpaid interest payments.[32]

The distribution of the farmers' indebtedness was also noteworthy. Total indebtedness of 271 farm owners ($3.1 million) was allocated among the various types of claims as follows:

Real estate secured debts	77 percent
Other secured debts	12 percent
Taxes	2 percent
Unsecured debts	9 percent

In many instances farmers had considerably higher debts on nonreal estate, secured or unsecured, as follows:

	Percent of petitioners
Petitioners whose debts secured by nonreal estate exceeded:	
20% of their total debts	26
30% of their total debts	17
Petitioners whose unsecured debts exceeded:	
20% of their total debts	28
30% of their total debts	12
Petitioners whose combined debts on nonreal estate exceeded 50%	13*

* Chiefly in North Dakota.

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shape, or if he is not financially sound, he may have to foreclose. If a lender weighs the soundness of his own financial structure against "having the borrower's interest at heart," the borrower has little chance to win.

[32] In the cases studied, many farmers had mortgaged their farms prior to World War I and their indebtedness therefore apparently did not result from the high land price and mortgage situation following that war.

Thus, to limit the farmer's rehabilitation to any given type of relief, or to limit this relief to any given type of claims, would not do justice to all petitioners or creditors.

(c) Confidence in the federal judicial system and closer understanding of the nature of debt-adjustment provisions would lessen opposition to them. If carefully drawn up by experts, creditors' rights and interests would be so safeguarded that it would be next to impossible for farmers to get "something for nothing." The Debt Adjustment Bill, for instance, fulfils these conditions. Hence a court will grant relief only after having weighed carefully the interests and attitudes of both parties.[33]

The judicial system has shown no signs of being hostile to creditors as a group. This is also true with respect to the Frazier-Lemke Act. In fact, during the first six years of its operation, lower courts discarded most of the petitions—and few farmers actually redeemed their property. This Act, specifically dedicated to farmers threatened with foreclosure, was effectively prevented from becoming operative throughout most of the depression.

It has been reasoned that the passage of the Moratorium Bill would forestall or prevent more "drastic" legislation.[34] If a Farmer-Debtor Relief chapter is to prevent farmers from being forced off their farms, an adequate bill would be one that attempts to cover as many eventualities as possible. In this manner it would be able to forestall a repetition of the 1920's and 1930's.

In the light of these economic and legal arguments, the Tenure Committee's statements[35] that a moratorium is adequate except "for hopelessly involved cases of individual mismanagement" or that provisions for scaledown should "be kept strictly separate from a simple, straight-forward foreclosure moratorium" cannot be supported.

Constitutionality and simplicity of procedure

(1) The Tenure Committee stated that the constitutionality of its four proposals is assured,[36] and supporters of the Moratorium Bill have im-

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[33] An important improvement over Section 75 in the Debt Adjustment Bill is the possibility of working out a "plan" *during the moratorium*. This greatly increases chances of arriving at a voluntary settlement between farmers and lenders, and decreases the relative weight of the redemption, which was the crux of the Section 75 procedure. It can be anticipated that under the Debt Adjustment Bill, considerable pressure would be exerted to avoid a redemption: a farmer would not apply for it unless he has secured new credit, or if his chances of obtaining new credit are slim, even though he is permitted to do so; creditors would tend to settle, if the farmer has found new funds. A farmer who does not attempt to work out a settlement would risk losing his farm if he has not yet arranged for new credit.

[34] See E. Feder, *Nebraska Law Review, op. cit.*, pp. 64 ff.

[35] *Op. cit.*, p. 24.

[36] *Op. cit.*, p. 24.

plied that the provisions of the Debt Adjustment Bill may be unconstitutional. The first statement is hazardous; the second misleading. The reliance on a federal judicial moratorium as the major form of relief and the lack of uniformity of treatment of creditors and debtors make the constitutionality of the bill questionable.[37] The legality of the Debt Adjustment Bill is practically assured. This bill is formulated along the general lines of Section 75, the constitutionality of which is now beyond doubt, and incorporates the jurisprudence involving interpretation and use of Section 75, and is patterned upon other chapters of the Bankruptcy Act.

(2) The Tenure Committee referred to its proposals as a "simple, straight-forward" procedure. The supporters of the Moratorium Bill have implied that procedures under the Frazier-Lemke Act were long and involved; but evidence gathered in the Great Plains does not support this view. In contrast, the relief procedures outlined in the Moratorium Bill promise to last longer and "clog the dockets of the district courts"[38] since the length of the emergency, which determines the length of the procedure, cannot be predicted.

A Blueprint for Effective Relief

In terms of care in preparation, adequacy of relief afforded farmers, and effective safeguards of the interests of *all* creditors, the Debt Adjustment Bill is superior to the Moratorium Bill. But even the Debt Adjustment Bill will fall short of an effective piece of legislation unless the experiences under the Frazier-Lemke Act are kept in mind.

A. *Credit funds for petitioning farmers.* Section 75 was used infrequently by farmers in distress partly because new credit was unavailable for redemption. Many farmers would have stayed on their farms had they obtained assistance. One farmer who was interviewed stated it well: "Without money, you can't refinance."

If a relief law is to become effective, special credit funds for petitioners, designed to pay out claims on secured real estate, on secured nonreal estate and on unsecured debts, and administered by one of the existing credit agencies, such as the FHA, or, preferably, by an agency especially designed for that purpose, are an absolute prerequisite. Loans granted on a long-term basis, with flexible repayment provisions and low interest rates, would be used to pay secured creditors at the appraised value of the property to be redeemed and unsecured creditors where necessary. Particular attention should be given the needs for operating expenses and additional loans be made available to continue normal operations.

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[37] E. Feder, *Nebraska Law Review, op. cit.,* p. 56. Fred Kruse, Hearings, *op. cit.,* pp. 30, 33, 35.

[38] F. Kruse, *Minnesota Law Review, op. cit.,* p. 739.

To the extent that redemptions threaten to increase individual creditors' losses, so that they bear the brunt of the debt adjustment, the establishment of special loanable funds through bonds or taxation would spread the risks throughout the economy.[39] Speedy and effective redemption would minimize the lenders' financial losses, and eliminate some of the objections now advanced against debt adjustments.

B. *Redemption appraisals at long-run income-earning values.* Secured creditors suffer losses through redemptions if the market value of the security falls below the amount of their claims.[40] If secured lenders are not restricted in their right to foreclose, their collection policy determines partly to what extent their claims against delinquent farmers will be allowed to grow in relation to the value of the security. With moratoria or debt adjustments, lenders lose this control. An excess of claims over the value of securities becomes a common phenomenon during depressions.

Losses of secured creditors could be reduced if redemptions of the property were made at the market value or the long-run income-earning value (or some percentage of this value) *whichever is the higher*. During periods of general farm distress, this would exert a stabilizing influence on the worth of farm assets.

Such a provision could function only if a special relief agency were set up, since it would necessitate larger funds for refinancing. It would leave the petitioner with a larger (new) indebtedness. If this would adversely affect the petitioner's ability to rehabilitate himself, the difference between the market value of the property and the long-run income-earning value (or some percentage of it) could be paid out of the relief funds as direct subsidy to the farmer.

C. *Increasing the chances of reaching composition or extension agreements.* In Section 75, the provisions on composition and extension were weak. Once the petition was made, the farmer's main aim was to go through with the redemption. The Debt Adjustment Bill materially increases the likelihood of a successful "plan,"[41] but still authorizes farmers to propose a redemption without previously attempting to reach such a settlement. Therefore the law should provide that a "plan" can be omitted only by mutual consent of secured creditors and the farmer. If a "plan" is offered but not agreed on, or not confirmed by the court, then redemption may be applied for.

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[39] For an equitable solution, see *Journal of Farm Economics,* May 1952, pp. 237-238.

[40] If land prices are high, such as at present, real estate secured creditors would not suffer losses through redemptions and farmers would have no reason to redeem the real estate unless they wished a change of creditor.

[41] See footnote 33.

D. *Making relief available to tenants*. Experience has shown that the Frazier-Lemke Act was not well adapted to the needs of tenant farmers.[42] Under the Act, farm operators were given relief with respect to their *debts*. Farm owners were assured of continued possession, at least until the end of the moratorium. However the Act did not provide that rental agreements be continued. If a tenant lost his lease, Section 75 was of assistance to him only as to his debts.

In order to make relief fully available to tenants, the rental agreement should be "frozen" throughout the length of the relief procedure and an adjustment of rental conditions authorized—subject however to the tenant's continued satisfactory farming operations. The court could supervise the latter and inquire periodically into the landlord-tenant relationship, as a protection for landlord and tenant alike.

E. *Establishment of a federal conciliation office*. Notwithstanding widespread opposition to conciliation commissioners, experience has shown that federal courts could not have coped with petitions under Section 75 without the assistance of conciliation commissioners. Both the Debt Adjustment Bill and the Moratorium Bill fail to reestablish this important agent. Interestingly these officials were criticized not only by lenders, but even by farmers, probably because under the law they had to operate in a dual position of "judge and jury" and had to work out and approve the arrangements between the petitioner and his creditors. This made them suspicious to both.

If the relief legislation would provide for a federal conciliation office, this handicap could be overcome. Composed of salaried attorneys paid from federal funds, it would occupy a neutral position. It could be set up as a part of the USDA or as an independent agency with various state offices. It would be essential in expediting relief cases and facilitating the work of federal courts.

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[a] According to *Collier on Bankruptcy* (Vol. V, p. 150), the applicability of Section 75 to tenant-farmers was doubtful and the law was interpreted variously by different courts.

OBSERVATIONS ON THE AGRICULTURE OF ARGENTINA

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THE intent of what follows is to report, especially to the agricultural economists of North America, on matters pertinent and significant to them concerning the agriculture of Argentina, insofar as such a report is likely to be worthwhile after a period of only three months of exploration by the writer.[1]

Argentina, except for being on the other side of the equator from the United States and Canada, is as much like these countries as one can really expect any large countries on the varied earth's surface to be. It is moreover a country like them with considerable dependence on export markets for farm products. Argentina's major agricultural exports before the second world war, and in 1950-55 (excluding the drought year 1952) averaged as follows in millions of pesos per year:

	1935-39	1950-55
Cereals and flax	918	1450
Meats	396	500
Wool	151	528
Hides	115	300
Dairy	20	283
Other	86	215
	1,686	3,276

The purpose of these figures is merely to show the relative magnitude of the different export items. The general price level of Argentina was 6.7 times higher in 1950-55 than in 1935-39. Hence the physical volume of agricultural exports was down by more than two thirds. Wool prices were 7.2 times higher in 1950-55 than fifteen years earlier. The dairy product exports of recent years have been mainly butter, cheese, and casein. Half of the cereals and flax item has been wheat, and one-seventh flaxseed. The meats in 1950-55 were three-fourths beef. The largest increase in the "other" group was in vegetable oils.

The U.S. Chamber of Commerce of Argentina has recently published a map that helps to visualize the geographic position and size of Argentina relative to the United States. This map shows Argentina placed upside down on the map of the United States, with the 30° South latitude

of Argentina overlaid on the 30° North latitude of about central Georgia and Northern Texas, and the Andes Mountains laid over the Rocky Mountains. Thus placed, the map of Argentina reaches out into the Gulf of Mexico about four degrees, and the southern tip pushes up through Montana into Canada. From the Province of Buenos Aires northward, Argentina is about 13 degrees wide, about equal to the distance from Atlanta, Georgia, to Dallas, Texas.

More important than the simple geographic position and size of this total area, however, is the circumstance that around 80 per cent of the agricultural output of Argentina is from the Pampas region, an almost continuously prairie region reaching westward about half way to Chile and both northwest and southwest from the city of Buenos Aires a total of about 9° of latitude. The rainfall of nearly all of the Pampas is in the range of 20 to 40 inches, and of two thirds of it 30 inches or more. To get a conception of this area, let one from the United States imagine an area as large as the four Corn Belt states, Iowa, Illinois, Indiana, and Ohio, 120 million acres, that is as level and naturally fertile as the good Corn Belt land, with about the same rainfall, but with the climate and growing season of the mid-South. A rough comparison with a comparable area of Corn Belt land shows the Pampas with greatly more wheat, much less corn and oats, more alfalfa and other forage, one-fifth more cattle, four times as many sheep, and one-fourth as many hogs. Thus by no means all the sheep of Argentina are in Patagonia. It will be apparent that climate plays a minor role in these differences. The agriculture practiced is therefore much more extensive than it would be if this area were in the United States. It is a region of cereals and cattle. The early settlers found the grazing of cattle on the natural grasses the easiest and most readily compensating form of land use. As world markets developed and more people sought a living on the land, much of the land was plowed and converted to cereal growing. In 1934-38 and 1955, sown acreage of cereals and flax in Argentina, virtually all in the Pampas, was distributed as follows, in thousands of acres:

	1934-38	1955
Wheat	16,500	13,100
Corn	15,400	6,600
Oats	3,200	3,100
Barley	1,600	2,400
Rye	2,100	5,500
Flax	6,600	1,600
	45,400	32,300

The years 1934-38 are taken because these were the peak years for most of these crops. The acreage sown to barley and oats increased to 1944-48. Not only has there been a large decrease since 1934-38 in the

acreage sown to cereals and flax, but more and more of the cereals are not being harvested for grain, but grazed in the field instead. In recent years, 87 per cent of the wheat has been harvested, 70 per cent of the corn, 65 per cent of the barley, 52 per cent of the oats, and 45 per cent of the rye.

The recent report of the Podor Ejecutivo Nacional of the Argentine Government, however, shows an increase of one per cent in total crop output between 1935-39 and 1950-55, omitting the bad drought year of 1952. The decline in cereal and flax output was 38 per cent between mid 1935-39 and mid 1950-55, but this was offset by a 95 per cent increase in fruits and vegetables and a 92 per cent increase in other crops—cotton, oilseeds, sugar cane, tobacco, etc. Hay is not included in any of these groups— in fact, the clovers and grasses are nearly all grazed. The alfalfa acreage is larger than that of any cereal.

The parallel report of the Ejecutivo committee shows an increase in the same period of 23 percent (compounded) in the output of livestock products, of 15 per cent for meat, animals (cattle, hogs, sheep), 19 per cent for wool, and 37 per cent for dairy and poultry products.

Combined, these two increases, weighted 70 for crops and 30 for livestock products, would make 7.6 per cent. The population increase in this period was 34 per cent. Thus agricultural output fell behind population growth by 20 per cent, or at the rate of 1.3 per cent per year. In the long stretch of years from 1900 to 1935-39, the comparable rate of decline was around 1.0 per year. Thus there was a small acceleration of the decline after 1935-39. This acceleration, it is apparent from the foregoing, was all due to the decline in output of wheat, corn, and flax, all export crops.

The crop that has retrograded the most is corn. After increasing in acreage five times from 1900 to 1936, it has fallen off nearly two-thirds in output. Yields per sown acre have fallen off one third, and per harvested acre by 10 per cent. The corn is of a flint type such as is suitable for export to Europe. It is doubtful if a large part of the export market for this corn can be recovered. If corn is to play the large role in the Argentine Pampas that it plays in our Corn Belt, hybrid dent types of corn for feeding to livestock and adapted to this more nearly semi-tropical type of climate will need to be introduced and maybe developed. Plant breeders are beginning work on this.

But the present domestic demand for corn, and for that matter other feed grains, is low. The beef cattle as well as the dairy cows feed very largely on grasses and clovers. In the winter months, these consist in large measure of rye, barley and oats, and the dairy herds are not able to eat enough of these to keep up the milk supply. A particular complication is that the cattle feeding on young oats, rye, or wheat for more than three

or four hours at a time may become afflicted with hypocalcemia, a calcium-deficiency disease which is not understood yet, and thus limited they do not get enough T.D.N.'s for full milk output. There is also much difficulty with bloat on young alfalfa and other clovers.

Animal husbandry specialists brought in from the U.S. or Europe usually stress strongly the need for supplementary grain feeding. But this could easily be overdone in very many situations. There is nothing like a sufficient market for all the dairy products and beef that would be produced in Argentina if the cattle were grain-fed to the extent that they are in the United States.

There has not been, in fact, a sufficient market for all that would have been produced if the available pasture land had all been really utilized. The 13,100,000 acres in cereals and flax in 1935-39 but not in 1955, has mostly become pasture, of course. Much of this has been simply by not plowing it and letting the grasses and weeds take possession of it. A familiar distinction in Argentina is between "natural" pastures and "artificial" pastures. The latter have been seeded to alfalfa, white clover, and other superior legumes and grasses. The natural pasture grasses provide rather poor winter pasture. But much more important, the natural pasture tends to be weedy, some of it almost beyond the imagination of one who has not seen it. Let someone from the heart of the Corn Belt imagine what prairie land natural pasture would be like if it were as far south as Arkansas. The thistle is the most serious weed pest. The writer distinguished five species of them, all but two more robust and spiney than the familiar Scotch thistle of the U.S. The artificial pastures also become badly weed-infested in a few years if they are not plowed and reseeded.

The projections outlined in the preliminary report prepared by the CEPAL group call for converting 8 million acres of pasture into cropland and 3 million acres of natural pasture into artificial pasture. This can be done very easily and quickly. How to do it is well and generally understood.

The major differences in the history of Argentine and U.S. agriculture are as follows:

1. Argentine agriculture continued its post-World War I expansion to about 1938, whereas that of the U.S. slackened somewhat from 1930 onward. Surpluses of several products had begun to accumulate in the U.S. even before the Big Depression.

2. With the sharp increase of demand coming with World War II, the U.S. surpluses were quickly absorbed and output increased even though prices of farm products were kept under moderate control. There was at that time a large backlog of unused technology waiting only for an assured market. With the sharp break upward in prices at the end of the war, output kept on expanding. The surge in application of new technology had taken so strong a hold that it

has been checked very little by the pre-Korean and post-Korean recessions of demand.[2]

3. In Argentina, in contrast, the output of cereals and flax began to decline after 1938, and this was not offset by enough advance in livestock and other output to keep up the pace for the whole.

4. The largest single factor in these differences has been differences in the rate of application of advanced technology. Output per worker in agriculture has scarcely gained at all in Argentina since 1935-39, whereas it has almost doubled in the U.S.

5. The largest factor in this has been mechanization. In the booming years of 1924 to 1930, Argentina imported more than 15,000 tractors and 25,000 combine harvesters. Imports almost ceased after 1938. High tariffs and rates of exchange unfavorable both to agricultural exports and to imports of farm machinery kept imports of farm machinery at a low level, and now there is a great dearth of foreign exchange. In 1938 an average tractor in Argentina cost 91 metric tons of wheat, compared with 33 in the U.S. By 1950, the 91 had become 193. By that time, 60 per cent of the tractors were 14 years old or more. Large numbers were out of use because of the lack of spare parts. Argentina's own tractor and harvester industry is developing very slowly. Corn harvesters have never been used except to a limited extent very recently, and likewise with cotton pickers. The corn production of Argentina needs to be adapted to mechanical harvesting or a different type of machine needs to be developed.

6. Along with the foregoing, the number of horses, which declined considerably from 1925 to 1938, has increased to almost its former peak. A factor in this is the low cost of keeping horses—the horses run on pastures and receive very little grain. Except on unusual occasions, they work only four hours a day. The farmer keeps enough horses for two shifts a day.

7. Also the machines used are very wide-gauge machines, so that the amount of farm labor is reduced.

8. Reduction in farm labor became particularly important when the government shifted to its industrialization policy around 1940. Peron's government even went so far as to require farmers' sons to register and take jobs in the cities. Also tractor drivers were required to join unions and to work on union schedules. Farmers were forced to hire union labor at high wage rates to load their wheat on trucks at the farm. Hence came the shift to cattle raising which requires least labor of all, and away from corn.

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[2] The index of farm output increased at the rate of 2.14 points per year from 1944-46 to 1955-56 as compared with 2.72 points from 1938-40 to 1944-46.

9. Very little advance was made in the adoption of other improved technologies. Wheat yields per harvested acre did rise, because of the use of better varieties, but few other such gains were made. There was none of the increase in the use of fertilizer that contributed so much in the U.S. Losses of cattle from foot-and-mouth disease are still large. It is estimated that loses from grasshopper and locust damage to cereal crops, alfalfa, and other forage have averaged about $100,000,000 in recent years. The damage to alfalfa is at the time of the year when the meat produced from alfalfa is scarcest in the British market. The increases in losses from weeds may have been almost as large.

There is general agreement among Argentinian students of agriculture that the land tenure system is another factor retarding recovery. Some tenancy laws that have been passed. They say that many owners of the "estancias" or larger holdings are not much interested in larger outputs. For one thing, in a period of inflation, having one's wealth in land is good even if there is no income. The general price level rose 8 per cent from 1954 to 1955, and 11 per cent from January 1955 to January 1956. Many of the landholders do not need a larger income from their land. Also many of the large landholders are much more interested in cattle or sheep than in crops. This raises questions about the size of the landholdings of Argentina. The 1947 census reported 13 per cent of the 471,400 farms as containing 1,100 acres or more. Some of the large landholders were landlords. Many of these have more than a few tenants and each tenant holding is counted as a separate farm.

The tenancy laws enacted in the Peron regime had two objectives, one to lower the rents paid, and other to keep the tenants from being forced to move every few years. The judgment of many in Argentina is that lowering the landlord's share of the crops has weakened his interest in further investment in equipment, land improvements, fencing, and the like. The frequent moving of the tenants from farm to farm was associated with the common rotation in the Pampas from pasture to crops and back to pasture. The tenants were crop-share farmers and moved to a new farm when a landlord shifted most of his land to pasture and livestock. The tenant now tends to stay on the same farm and grow the same crop year after year, which rapidly reduces the yields.

Few of the farms of Argentina have a barn of any kind. (They may have shelter for machinery and storage for grain.) On the dairy farms, the cows are milked in the open. No dairy farms have milking machines or cream separators. The milk is hauled directly to creameries or to cheese factories. The cream is then hauled to rather large butter factories.

The cattle are of unusually good breeding. This came about because the well-to-do estancia owners imported pure-bred cattle and their off-

spring have been distributed widely. The beef breeds are mostly Angus, Shorthorn, and Hereford. The dairy cattle are almost all Holanda, the Dutch variant of Holstein-Frisian. Many of the farms with Holanda cattle, especially distant from the larger cities, let the calves do much of the milking.

The land in the Pampas is mostly in fenced-in large fields, with little in the way of detailed lay-out and rotation system. The fences are of barbed wire and have slender posts of quebracho wood from northern Argentina, the posts being far apart.

The economic development programs being conceived for Argentina call for a vigorous restoration of its agriculture. One of the reasons for this is the strong need for foreign exchange. A rather large reserve of foreign exchange was built up as export demand rose in the late war and immediate postwar years. But the government put this to relatively unimportant uses—buying the railroads from the British, paying off foreign debt, and subsidizing domestic consumption of beef and bread. Foreign exchange is needed, of course, to buy spare parts and machines for the farms, bug and weed killers, etc. One of the preliminary program projections calls for a 70 per cent increase in agricultural exports over those of 1950-55[3] by 1960, including 110 per cent for beef and other livestock products. The increases in crop exports projected are mainly in corn and other cereals, with no increase for wheat, and in flaxseed and other oilseeds.

Production of farm products for domestic consumption is projected to increase more than one-fourth over the average of 1950-55,[3] nearly half of this because of a projected 12 per cent increase in the population by 1960, the rest, of course, to arise from a projected large increase in per-capita income and a rather high income elasticity of food consumption. Purchases of products of agricultural origin at the retail level are estimated to have an income elasticity of around 0.65. Marguerite Burke's figure for the U.S. is apparently 0.40.[4]

The increase in agricultural output that will be called for by such a program is close to 40 per cent by 1960. Does this seem at all reasonable in view of the increase of only 7.6 per cent since 1935-39? The answer is that it is easily possible according to U.S. standards of achievement. The proposed plowing up of the 11 million hectares of weedy pasture and presently seeding 3 million hectares of this to alfalfa and grass-clover mixtures would alone more than achieve the goal. Controlling the locusts and grasshoppers would alone contribute a sizeable fraction of the increase. Both of these would call for imports, in order of priority, of chemicals and planes for spraying, of spare parts, and then of tractors and

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[3] Excluding the drought year 1952.
[4] Rex Daly's article in *Agricultural Economic Research*, July 1956, p. 78.

combines. But the increased exports resulting would much more than cover the exchange requirements.

These projections are really 7.5-year projections—from mid-1950-55 to 1960; but 1960 is only 3 years beyond the 1957 crop year. In general, no increase has thus far occurred. Large increases in 1957 are being expected by the government officials. The sown acreages thus far reported indicate this. The provisional government announced early its intentions to support higher prices for farm products and finally came through with some very large guaranteed increases that apply to the crop now being grown. These increases expressed as increases from 1954-55 are: wheat, 50 per cent; corn, 70 per cent; oats, 58 per cent; barley, 40 per cent; flaxseed, 120 per cent; peanuts, 90 per cent. Prices of all farm products had risen by last September by about 50 per cent above those of 1954-55; but prices of nonfarm products had risen about 30 per cent. Farm product prices were still 7 per cent below those of nonfarm products on a 1939 base.

Some serious questions must be raised about these price supports. First, will some of them not raise domestic prices above those in the export market, thus making subsidies necessary if there are to be exports? This surely would be a dubious use of scarce public funds, although exactly the opposite of the policy followed in the 1940's. Second, will not such a program raise the cost of living too much and make wage and inflation control more difficult? After all, will it not be wise to go only so far as to take off the present consumer subsidies on meat and bread? Third, will it not be better for an inflation-plagued nation if the desired increase in exports can be achieved by such measures as imports of spare parts, chemicals, spray equipment, and machines than by price increases?

This third question raises the whole matter of the response of the agricultural output of Argentina to price changes. No doubt prices had a considerable part in the lagging of agriculture after 1938. But they were only part of a whole set of anti-agricultural measures. Attempts to apply conventional price and supply analyses to the problem yield no usable results. For most crops there are more years in which the acreages sown move in the same direction as real prices in the preceding year than the reverse, even after allowing for possible trends. Stretches of several years can be found when acreages sown move in the opposite direction from several years of higher or lower prices. But there are more sequences when they don't. One has to conclude that other factors than prices have played a larger role than prices in acreage changes. It is conceivable, of course, that careful detailed analysis could isolate some of these factors and also price effects. But some of the influences would surely prove to be episodic.

It seems best, therefore, for Argentina to proceed very cautiously with

a program of support prices. If this year's acreages do actually increase sharply, it would appear wise simply not only to call a halt on further increases, but even to lower some of them. But what effect on the development of Argentina's agriculture would such a reversal have? It may be that it was assurance of *continued* price supports by the present government that has produced this year's response.

One who comes to Argentina from the United States can hardly forbear from remarking that Argentina will find it a lot easier to solve its agricultural problems resulting from under-supporting its agriculture than the United States is finding it to solve its problems arising from over-supporting its agriculture.

Indeed, there is a real possibility that Argentina will now fall into the trap that the United States fell into. The potentials for rapid expansion of agriculture in Argentina are clearly larger than in the United States. Some of the readers of this article will remember that the President's Materials Policy Commission (P.M.P.C.), in its report, *Resources for Freedom,* concluded, on the basis of judgments of the nation's agricultural scientists, that if the agricultural technology now known were generally applied to the land now being farmed in the United States, output would be increased by 85 per cent. If this same technology, adapted as needed, were applied to Argentina's land now in farms, the judgment of this writer is that the 85 per cent would be at least 150 per cent. Argentina therefore faces a difficult problem of keeping its agriculture adjusted to its markets. This is particularly true because of the large dependence on export markets mostly in Europe. The safest program for Argentina to follow will therefore be to keep its domestic prices closely in line with those in the world market and strengthen its agriculture by making it more efficient, in marketing as well as in production.

This discussion is purposely limited to Argentina's agriculture. But the progress of its agriculture is greatly dependent upon that of other parts of its economy. Most vital to its agriculture is the rehabilitation of its railway system. Both roadbed and rolling stock have been allowed to deteriorate to the point where the freight service is inadequate for both crops and livestock. Still more serious is the deficit of power. Argentina apparently has the necessary natural resources of petroleum and gas, but they have been developed only to a limited extent. Very few of the farms are served with electricity. In spite of the measures favoring industry, no large progress has been made, scarcely none in output per worker in industry. A large part of the heavy migration to the cities has been absorbed in an expansion of service occupations, including retailing.

To achieve the general economic development that Argentina needs in the decade ahead, and that the rest of the world, and especially South America, needs from Argentina, is going to require large additions of

capital as well as improvement in the arts and skills of management and labor—what Professor T. W. Schultz refers to as the "qualitative." More of this capital could come from Argentina itself if its propertied class would invest freely in home enterprises. A stable government from now on would help greatly in this direction. Investment of outside private funds is also going to be needed. Rates of return in such investment have generally been very high. The former government, however, not only blocked these earnings with the object of forcing their expenditure in Argentina, but went so far in some cases as to prohibit their use in expansion of plant and the like. The present government has, of course, reversed this policy in large part; but there is still enough opposition to the invasion of foreign firms into Argentina to impose something of a barrier to progress from this source. In the past, Argentina also has not shared in the financial aid furnished by public international agencies. Apparently this is in process of being changed.

The plans for economic development being conceived by leaders of economic thought in Argentina place much emphasis on production for export. This arises from the continuing need for imports of certain raw materials, and the shorter-run need for machines and equipment if recovery is to be fast. In the past, it was agriculture that provided most of the foreign exchange, and it is only natural for this source to be sought again. But much more purchasing power abroad, than its agriculture can provide, is going to be needed if Argentina is going to start surging forward.

The final observations have to do with international trade within Latin America, and especially within South America. An ECLA conference was held on this subject at Santiago in November 1956. To take an extreme case, Chile does not provide enough wheat and meat for the needs of its own population, and Argentina has an export surplus of both. Chilean agriculture is much like that of California, or at least should be. For Chilean agriculture to be isolated from the Argentinian market is much like isolating that of California from the rest of the United States. Our country needs to assist in any way it can in promoting trade among the nations of South America, not hinder it as it is now doing with some of its surplus disposal actions. Any surplus of Chilean exchange that may arise from this trade can be used by Argentina to buy raw materials from other South American countries, and they in turn can use the Argentinian exchange to buy copper and fruit in Chile. The best example of such triangular exchange is, of course, Brazil's use of dollar exchange from coffee sales to buy wheat from Argentina, the proceeds to be used to import equipment from the United States.

ANALYZING THE SOLUTION TABLEAU OF A SIMPLEX LINEAR PROGRAMMING PROBLEM IN FARM ORGANIZATION[*]

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THE objective of this paper is to enable farm managers and others to determine the feasibility and stability of linear programming solutions to their specific organizational problems. This procedure is demonstrated by presenting (1) a farm situation, (2) production possibilities and the organizational problem of selecting a production combination from these possibilities, and (3) a solution tableau and an analysis of this tableau. This type of detailed analysis, not having been fully treated in other articles, is presented to enable farm managers and others to bridge the gap between mathematical solutions and practical application–to realize the ripened fruit of a linear programming solution.

Attention is directed toward certain computations that should be performed *after* an "optimum" farm organization has been obtained. No discussion of the technical computational details of arriving at the optimum farm organization will be made.[1]

The Farm Situation

The farm for which this plan was made is in Central Indiana. Available resources included 316 acres of Brookston, a black prairie-type soil, in a high state of fertility; 305 acres were tillable. Corn yields have averaged between 90 and 95 bushels per acre. Yields of oats and meadow have been correspondingly high. The farm is being farmed by two men; the operator is about 33 years old and has one competent hired man. Not only is the operator a capable crop farmer but he is also skilled in livestock management. He maintains a high level of feeding efficiency. The farm is highly mechanized with 4-row equipment, mechanized feed handling, automatic water, etc.

[1] For such details see: A. Charnes, W. W. Cooper and Henderson, *An Introduction to Linear Programming*, New York: John Wiley and Sons, Inc., 1953. Robert Dorfman, *Application of Linear Programming to the Theory of the Firm*, Berkeley: University of California Press, 1951. Earl O. Heady, "Simplified Presentation and Logical Aspects of Linear Programming Techniques," *Journal of Farm Economics*, Vol. XXVI, No. 5, December, 1954.

The limiting factors considered in planning were only four in number—land, labor, hay equivalent and corn equivalent. Corn equivalent was limiting in the sense that the farm could only produce some maximum amount of corn. However, purchased corn could be used in livestock production but this corn was priced 10¢ per bushel higher than the sale price for corn raised on the farm.

Production Possibilities

Production possibilities considered are summarized below in Table 1. The optimum farm plan (program) had to consist of some combination of these 10 enterprises or activities.[2]

TABLE 1. ENTERPRISES CONSIDERED IN THE FARM PLAN FOR THE CENTRAL
INDIANA CASE FARM

Crop rotations[a]	Livestock enterprises	Direct purchase and sale of crops
CCCCOM	Beef-cow herd	Buying corn
CCCOM	Two-litter hog enterprise	Selling corn
C	Calf-feeding program	Selling hay
M		

[a] C represents Corn.
M represents Meadow.
O represents Oats.

Budgets had to be made for each of the various crop-and-livestock production possibilities to obtain choice indicators that could be used to determine the optimum combination of enterprises by conventional programming procedures. The choice indicator used was a "profit" figure per unit of each enterprise. The results of this budgeting appear in the C row and C column of Table 2 where they are associated with the various enterprises considered for the farm plan. For example, the first figure in the C column is —$23.06 indicating a net return or cost of producing the CCCOM rotation. Such figures do not include overhead costs of fixed factors nor returns from any crop that may be processed through a livestock enterprise considered in programming. No charge is made for labor or land. The costs considered are the variable costs resulting from the use of factors, such as gasoline, which for practical purposes are of unlimited supply. Labor and land appear in our problem as limited in availability. Their value in production is determined during the programming rather than by use of arbitrary accounting values.

Similarly, the $458.06 indicated as the return to the hogs (sow and 2 litters) is a net price. That is, variable costs such as veterinary fees, pro-

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[2] Production possibilities, enterprises, activities, and processes may have slightly different meanings for certain agricultural economists, however, in this paper they are considered as interchangeable.

tein supplement, etc. have been deducted from the total returns as have the costs of the gilts to replace or maintain the system. Corn, however, was not charged against the hogs since this action takes place during the programming; we wish to make optimum use of corn rather than arbitrarily budget-in a cost of production. Corn is programmed into those uses where it will bring the highest return. Since it has a market value of $1.20 in our case, we are assured that no activity will use corn without returning $1.20 or more per bushel for its use.

The production period (1 year) was the same for all enterprises. "Units" for enterprises consisted of 1 acre for crop rotations, a cow and a calf for the beef-cow herd, a sow and 2 litters for the hog enterprise, and a calf for the calf-feeding enterprise. Bushels and tons were the units used for the buying and selling of corn and hay.

The budgeting data are not presented here since the purpose of this paper is to discuss the interpretation of a linear programming problem and not budgeting methods that are common to both conventional budgeting and linear programming. Choices made regarding price anticipations and production methods affect the validity of the optimum farm organization, of course, but considerations of this kind are not peculiar to linear programming procedures.

The Solution Tableau

The solution tableau of the simplex linear programming worksheet (Table 2) contains the optimum farm plan and considerable information regarding the economic relationships among the various production possibilities.

An optimum farm plan—the P_0 column. In the solution tableau the P_0 column contains the levels of activity associated with those production possibilities that become part of the optimum farm organization. The amount of the limited factors unused (if any) will also appear in the P_0 column.[3] Perfect divisibility of inputs and outputs is assumed in linear programming; therefore, the figures in the P_0 column may not consist of whole numbers only. This means that the "optimum" organization as developed by linear programming cannot always be followed precisely, because in real life certain inputs and outputs cannot be broken into fractional units.

In the example illustrated by Table 2, rounding to eliminate the decimal part of the P_0 column may be considered sufficient to obtain a work-

[3] In a linear programming problem the number of enterprises in the final solution must equal the number of limiting factors in the initial tableau. For a mathematical exposition of this point see, M. M. Babbar, "A Note On Aspects of Linear Programming Technique," *Journal of Farm Economics*, Vol. XXXVIII, No. 2, May 1956, pp. 607-609.

TABLE 2. THE FINAL OR SOLUTION TABLEAU

C			$1.20		$16.00		$−23.40
					Idle		CCCOM
			Corn eq.	Hay eq.	Labor	Land	
		P_0	P_1	P_3	P_4	P_5	P_6
$−23.06$	CCCOM P_6	292.91747	.04000	0	−.17218	4.34739	.90586
458.06	Hogs P_9	100.04193	.00091	0	.01881	−.04213	.00240
−32.34	C P_7	12.08253	−.04000	0	.17218	−3.34739	.09414
16.00	Hay eq. P_3	134.28815	.03108	1	−.15657	3.52001	.05227
	Z	40828.39098	1.28531	16	4.51316	45.02587	−21.99796
	Z-C	40828.39098	.08531	0	4.51316	45.02587	1.40204

C		$−23.06$	$−32.34$	$−16.04$	458.06	81.85	110.50	$−1.30$
		CCCOM	C	M	Hogs	Beef cows	Feeders	Corn buying
		P_6	P_7	P_8	P_9	P_{10}	P_{11}	P_{12}
$−23.06$	CCCOM P_6	1	0	3.48641	0	−3.90535	−1.50422	−.04000
458.06	Hogs P_9	0	0	.05196	1	.47944	.41940	−.00091
−32.34	C P_7	0	1	−2.48641	0	3.90535	1.50422	.04000
16.00	Hay eq. P_3	0	0	−1.26291	0	2.39639	.92175	−.03108
	Z	−23.06	−32.34	3.60812	458.06	221.71288	192.89920	−1.28531
	Z-C	0	0	19.64812	0	139.86288	82.39920	.01469

able solution. On the other hand, considerations not specifically put into the mathematical model (existing fencing arrangement perhaps) might be of sufficient magnitude to make the use of two crop rotations impractical and the rotation of C (continuous corn) would then be eliminated entirely. Thus, while the P_0 column contains the exact mathematical optimum for the assumptions made, these assumptions are often over-simplifications of the real situation. Hence, they usually deviate enough from the actual situation to render the farm organization obtained by linear programming only an approximate one from a practical viewpoint. This situation is, of course, no different with ordinary budgeting of farm situations. Additional equations and unknowns can be used to make the linear programming approach more nearly the real farm situation. Ordinarily the more nearly one makes the program approach the farm situation, the greater the complexity and difficulty of solving the problem. Furthermore, production information is usually unavailable in as refined detail as would be required.

The Z-C row of the P_0 column contains the total dollar return to all fixed factors of production estimated from the optimum program or plan. This total dollar return, $40,828, estimates the returns to cover machinery costs that would go on whether the crops were raised or not, building costs that would continue regardless of the farm organization, etc. In general, the total returns computed are a maximum obtainable from the activities considered and maximize net income, labor income, manage-

ment income or other such income figures. The unallocated returns to labor, land and forms of fixed capital may be divided upon an arbitrary basis by the residual technique if so desired. It is worth noting however that no arbitrary decisions about the returns to labor or land were necessary in the actual programming of the farm.

Costs of deviating from the optimum plan—the Z-C row. The Z-C row, for columns other than the P_0 column, contains the marginal cost of substituting units of the enterprise associated with the particular column into the farm organization indicated as optimum. For example, in the corn equivalent column (P_1) we find $.085 in the Z-C row which indicates that for every bushel of corn sold the total return would be reduced by $.085, provided the other enterprises are reorganized to make the best possible use of all resources. At the optimum combination of enterprises, the marginal cost for those enterprises forming a part of the optimum combination is zero. This is logical, for if it were profitable to add additional quantities of this enterprise an optimum solution would not have been obtained, and if it were not profitable to add the last increments of this enterprise an optimum would not have been realized. The marginal costs for those enterprises not in the optimum organization will be positive or zero indicating the cost per unit associated with the addition of units (or a fraction of a unit) of the particular enterprise into the farm organization. The marginal costs take into consideration the opportunity cost of all the other enterprises in the particular problem combined in the most profitable manner.

Marginal costs change with the level of output or input. In linear programming these changes are of discrete nature because of the linear nature of the analysis. Hence, the marginal cost of adding an enterprise to the plan with all resources recombined in best possible fashion will remain constant over some range. The range for which these marginal costs remain the same is useful information on which to base changes in farm plan and will be referred to in this paper as the "valid" range. In the case of selling corn the cost of selling (decrease of profits from the maximum) is roughly 9¢ per bushel (Table 2, Z-C row). The valid range is from 0 to 4,321 bushels of corn. However, the marginal cost, 9¢, is the minimum per bushel cost of selling corn. This marginal value is based on the presumption that the enterprise combination is adjusted to maximize profit when any amount of corn within the valid range is sold. Hence, when 4,321 bushels are sold, the enterprises are recombined (Column 5, Table 3) to include 185 acres of C, 120 acres of CCOM and 96 sows on a 2-litter system. The mechanics of discovering such combinations are quite simple.

To compute the valid range for a marginal cost figure, an R column is computed using the positive values in the marginal cost column as the

denominators and the values in the P_0 column as the numerators for the various ratios. For example to compute the valid range for the marginal cost associated with the P_1 column, corn idle or sold, compute:

P_0		P_1		R
292.91747	÷	.04000	=	7322.93675
100.04193	÷	.00091	=	109936.186
12.08253	÷	—.04000	=	
134.28812	÷	.03108	=	4320.72554

The smallest ratio in the R column is the figure obtained by dividing the P_0 figure associated with the hay equivalent row by the corresponding figure in the corn equivalent idle or sold column. This ratio (4320.72554 is the extreme of the valid range for the marginal cost figure of the corn equivalent idle or sold enterprise ($.09). Furthermore, it is known that in order to lose only $.09 per bushel on corn sold, for 4,321 bushels, the corn equivalent idle or sold enterprise must be substituted for hay equivalent idle or sold. The complete reorganization necessary to keep losses at

TABLE 3. THE RANGE IN ENTERPRISE PRODUCTION OVER WHICH THE MARGINAL COST FIGURES ARE VALID AND THE CORRESPONDING MOST PROFITABLE ENTERPRISE ORGANIZATION THAT ACCOMPANIES THE MAXIMUM POINT IN THE RANGE

Enterprise	Unit	Marginal cost	Valid[a] range 0 to	Most profitable organization consistent with maximum point in the valid range for each enterprise
Corn sold (idle)	bushel	$ .09	4,321	4,321 bushels corn sold, 185 acres of C, 120 acres of CCOM, and 96 sows on 2-litter system
Labor idle	hour	4.51	70	70 hours of idle labor, 145 tons of hay sold, 98 sows on 2-litter system and 305 acres of CCCOM
Land idle	acre	45.03	38	38 acres of land idle, 140 acres of C, 127 acres of CCCOM, and 102 sows on a 2-litter system
CCCCOM	acre	1.40	128	128 acres of CCCCOM, 177 acres of CCCOM, 128 tons of hay sold, and 100 sows on a 2-litter system
M	acre	19.65	84	84 acres of M, 221 acres of C, 240 tons of hay sold, and 84 sows on a 2-litter system
Beef cows	cow	139.86	3	3 beef cows, 99 sows on a 2-litter system, 127 tons of hay sold, and 305 acres of CCCOM
Feeder calf	calf	82.40	8	8 feeder calves, 97 sows on a 2-litter system, 127 tons of hay sold, and 305 acres of CCCOM
Corn buying	bushel	.01	302	302 bushels of corn purchased, 144 tons of hay sold, 305 acres of CCCOM, and 100 sows on a 2-litter system

[a] Valid range refers to the range of production over which the indicated marginal cost cost figure remains the same. Beyond this range the marginal cost will be higher than indicated.

this minimum is obtained by following the normal procedure for calculating the P_0 column of a new tableau. A drop in returns to all fixed factors (Z-C row, P_0 column) occurs as the new organization is calculated, *i.e.*, a "backwards" solution is obtained.

The method of calculating the extreme point of the range over which the marginal cost figures are valid and the reorganization consistent with this extreme point is one of *arbitrarily* selecting the enterprise to be substituted into the optimum tableau to form a new organization that is optimum *under the assumption that the arbitrarily selected enterprise must be in the organization*. The Z-C value for the enterprise removed from the optimum organization will be negative in the "backwards" solution and others may be negative. However, the Z-C value for the enterprise removed will always be the smallest (greatest negative) value, indicating that the best move from this position would be back to the original optimum solution.

A positive check of the validity of this extreme point can be made by multiplying the size of the new enterprise by the marginal cost figure for this enterprise in the optimum tableau. The value so obtained will equal the difference between the returns to all fixed factors in the optimum and the new organization.

One value of the marginal cost figures and their valid ranges lies in their use as stability indicators. The organization in the optimum solution may be looked upon as stable if relatively large changes in prices and/or production coefficients are necessary before a change in the solution would occur. The organization in the optimum solution is relatively stable, if the values associated with the marginal cost figures for enterprises not in the optimum solution indicate that large losses in income will result from an inclusion of these enterprises in the farm organization. The range over which the marginals are valid is also valuable in analyzing the stability of any organization. Even when the marginal cost of change is small the organization may be relatively stable, since the valid range of the low marginal cost may be very short. Beyond the extreme point of the valid range the marginal cost of additional units introduced into the organization will always increase.

Since opportunity costs are considered in the marginal costs, they indicate the dollar profit increase per unit necessary before an enterprise would be included in the optimum organization. These figures are summarized in Table 3 where we can see that if the sale price of corn were to be raised $.09 per bushel or if an alternative use of labor appeared offering $4.51 per hour our program would no longer be optimum.

The drop in total income[4] caused by shifting to an alternate farm

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[4] Profit (return to all fixed factors) from the optimum enterprise combination is found in Z-C row, P_0 column, in Table 2.

TABLE 4. RANGE IN PROFITS FOR WHICH THE PROGRAM REMAINS OPTIMUM[a]

Enterprise	Profit used in budgeting the optimum	Range in profit for which the program remains optimum	
		Lowest profit before program would change	Highest profit before program would change
CCCOM	$−23.06	$−24.61	$−22.69
Hogs	458.06	364.31	474.20
C	−32.34	−32.71	−30.21
Hay eq. sold	16.00	13.24	16.47
Corn	1.20	b	1.28
Labor (idle)	0	b	4.51
Land (idle)	0	b	45.02
CCCCOM	−23.40	b	−22.00
M	−16.04	b	3.61
Beef cows	81.85	b	221.71
Feeders	110.50	b	192.90
Corn buying	− 1.30	b	− 1.28

[a] Profit refers to the return above nonlimiting variable cost per unit of the enterprise. Those used in the programming appear in the C-row and C-column of Table 2.
[b] Since the enterprise involved is not in the optimum farm plan, only a rise in profits to this enterprise or a drop in the profits to another can effect a change in the optimum; a drop of profits, of any magnitude, can have no effect on the optimum combination.

organization is obtained by multiplying the marginal cost times the extreme point of the valid range, e.g., the cost of changing from an organization that sells hay to one that sells corn is $388.89 ($.09 × 4,321 = $388.89). If little difference in income is realized by shifting to the alternate organizations, perhaps considerations not accounted for in the rigid mathematical model might make an alternate organization preferred over the "optimum" organization. Such consideration might include soil fertility or conservation problems not adequately treated in the original budgets, personal preferences, existing fencing arrangement, or perhaps risk and uncertainty considerations.[5]

Effect of changes of profits from enterprises. It is also of interest to know how much the returns (profits) per unit of an enterprise included in the optimum plan can change before a change in the plan would be indicated. For example, in the final tableau shown in Table 2 it might be useful to know how far the returns per unit of hogs ($458.06) could drop or rise before some other plan involving either different levels of the enterprises or different enterprises would be more profitable. Such figures (Table 4) can be obtained from the final tableau by using some very simple computational procedures.[6]

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[5] For a detailed discussion of programming methods where uncertainty considerations are treated in a more precise manner see: Rudolf J. Freund, "The Introduction of Risk into a Programming Model," *Econometrica*, Vol. 24, No. 3, July, 1956.
[6] Other prices assumed to remain unchanged.

The values in the final tableau, except for profits and the Z and Z-C rows, are based on physical rates of substitution and transformation for the limiting factors among the various enterprises. The choice indicators or profits can be shifted to some extent without forcing the values in the Z-C row negative. Unless this negative condition occurs no more profitable solution can be found. Hence, we wish to discover the range over which we may shift these net prices without causing negative Z-C values. By using simple arithmetic we illustrate, starting with the P_1 column (corn equivalent), and find the change in hog profits that may occur without causing the Z-C value to become negative.

$$
\begin{pmatrix} \text{Profit of hogs} \\ \text{in C column} \end{pmatrix} - \frac{\text{(Value in Z-C row)}}{\begin{pmatrix} \text{Coefficient in the hog} \\ \text{row, } P_\theta \text{ column} \end{pmatrix}} = \begin{pmatrix} \text{A possible limit to range in profit figure} \\ \text{for hog enterprise} \end{pmatrix}
$$

$$
458.06 - \frac{.08531}{.00091} = 364.31
$$

In this instance, the profit of hogs may drop from \$458.06 to \$364.31 without forcing this particular Z-C value to become negative. However, it is possible that a smaller drop in hog profits could make one of the other Z-C values (another column) negative. We go on, therefore, to examine the effects in these cases of changing hog profits. For column P_3 using the same method,

$$
458.06 - \frac{4.51316}{.01881} = 218.13
$$

In this case hog returns above nonlimiting variable cost could drop to \$218.13 before a change in the optimum solution would be indicated. However, our previous trial only permitted a drop to \$364.31 so that is tentatively the lower limit of our profit range. Continuing the above process we find the following values: \$364.31, \$218.13, \$126.80, −\$126.12, \$79.92, \$166.34, \$261.59 and \$474.20. Since \$364.31 is the highest of those less than \$458.06 it remains the lowest profit to which hogs may drop without indicating a change in the optimum program. On the other hand, some of these figures are greater than \$458.06. The first one above \$458.06 is \$474.20, hence, we have an upper limit to the return range before some other program is indicated.

Once the ranges in returns per unit of enterprise are obtained, the variation may be attributed to one of the factors involved in returns, e.g., prices. Referring to Table 5, we note that the other return factors total \$18.12 and the variable nonlimiting costs, \$79.00. The difference is \$60.88. If the profit or return over variable nonlimiting costs is to be at least \$364.20 (the lower end of our range) the return from selling pigs must be at least \$60.88 plus \$364.20 or \$425.08. By taking account of the various factors, we get the following:

TABLE 5. PROFIT (RETURNS) BUDGET FOR THE HOG UNIT

Pigs per litter	Weight of hogs in hundred weight	Price per hundred weight used in programming	Total Returns	Range in prices and returns for which the plan remains optimum			
				Low		High	
				Price	Returns	Price	Returns
7.5[a]	2.25	$16.40	$276.75	$13.430	$226.63	$16.900	$285.19
6.9[b]	2.25	15.60	242.19	12.791	198.58	16.096	249.89
Other returns .23 cull sow	3.25	13.50	10.12		10.12		10.12
Manure credit			8.00		8.00		8.00
Variable nonlimiting costs							
Supplement and minerals			−50.00		−50.00		−50.00
Veterinary fees			−12.00		−12.00		−12.00
Breeding fees			− 2.00		− 2.00		− 2.00
Electricity			− 5.00		− 5.00		− 5.00
Fuel			−10.00		−10.00		−10.00
Profit figure			$458.06		$364.33		$474.20

[a] Spring pigs.
[b] Fall pigs.

No. of fall pigs per litter	Wt. of market pig in cwt.	Fall pig sale price	No. of spring pigs per litter	Wt. of market pig in cwt.	Spring pig sale price assuming it to be 5% higher than Fall pig price per cwt.	
(6.9)	(2.25)	X +	(7.5)	(2.25)	(X + .05X)	= $425.08

$$X = \$12.791 = \text{minimum price of fall pigs per cwt.}$$

$$X + .05X = \$13.430 = \text{minimum price of spring pigs per cwt.}$$

Similarly, the upper limit in prices can be found that will lead to a return of $474.20 over variable nonlimiting costs.

Thus, supposing spring pig prices are 5% higher than fall pig prices and using the methods shown, prices could range as follows without affecting the optimum plan:

	Low	*High*
Fall pigs	$12.79 per hundred pounds	$13.43 per hundred pounds
Spring pigs	16.10 per hundred pounds	16.90 per hundred pounds

The profit budget for the hog unit (Table 5) is given in order to illustrate this change. The figures in the boxes at the bottom of Table 5 correspond to the high and low values of a hog unit in Table 4 except for rounding errors. One can, of course, attribute the change to any of the other variables, such as supplement, just as easily.

In the case of the rotation, CCCOM, the variable costs of production per rotation acre associated with this rotation would have to go above

$24.61 (minus sign indicates cost rather than return) before the optimum plan would change. On the other hand the costs could lower to $22.69 without changing the optimum.

The ranges in profits for enterprises not already in the optimum solution are indicated by the figures in the Z row of the optimum solution as found in the final tableau (Table 2). Whenever these figures are positive the net profit would have to reach a corresponding value before it would become profitable to make a change in the final solution. Similarly, if these figures are negative the net cost of the enterprise under consideration must be at least that great (negative) or a change in the solution would be indicated.

The possibility of changes in prices without corresponding changes in the optimum organization is, in general, a result of the linear assumptions used in programming. However, as long as the linear relationships used in our budgeting and programming are reasonable approximations of the production relationships within the range in which we operate, the results of programming and interpretations with respect to price changes and stability should be reasonable.

Summary

The analysis of the solution tableau for this farm problem indicated that the farm plan was relatively stable. Hogs, which constituted the major income enterprise, would have to drop about $2 to $3 in price before other livestock enterprises could compete (production coefficients assumed correct as used). A rise of around $.50 in the price of hogs would have changed the picture, however. A rather high opportunity cost would be incurred if the crop rotation were shifted to one producing a great deal of meadow and, in general, it was more profitable (under the price assumptions made) to sell hay than to feed it. However, the loss in income would have been only $389 if for some reason the sale of hay should be considered undesirable.

Thirty-eight acres of land could have been left idle at an average cost of $45.03. More than 38 acres idle would result in an average cost of more than $45.03 per acre. This information might be valuable in deciding whether or not to enter such governmental programs as the soil bank.

The marginal cost figures (the Z-C row) can be deceiving unless the valid range for such figures is calculated. Beyond this point the marginal cost of introducing additional units of enterprises not in the optimum plan becomes greater.

Some degree of variation in prices or enterprise returns above nonlimiting variable costs can occur without another farm organization becoming more profitable under the programming techniques used. For

example hog prices could vary about $3.00 to $3.50 per hundred weight without necessitating a different optimum farm organization.

The method for calculating ranges for marginal cost figures (Z-C values) is not difficult and is of considerable importance in evaluating solution tableaus. Likewise, the method for calculating ranges of the net prices (C row values) for which programs are optimum is easily followed. Obtaining values for these two sets of figures results in a better understanding of the stability features of any programming solution. Almost all of the information that could be obtained by calculating separate solutions for various price combinations can be obtained from one solution. Obtaining ranges for the net prices is comparable to programming with several sets of prices, since the changes in the net prices can be easily interpreted in terms of commodity price changes. The calculation of ranges for the net prices is more flexible than merely changing commodity prices, in that the changes may be attributed to changes in production methods or factor prices as well as to commodity prices. These calculations can be made entirely *after* the normal calculations for obtaining an optimum solution are made, *i.e.*, no anticipation of what ranges are desired need be made before the optimum solution is obtained.

The problem discussed is a basic or skeleton problem set up and calculated to indicate the key points of this particular farm problem. An expansion of the problem to include such details as labor distribution, capital requirements, and acreage allotments can be made by the addition of more enterprises (unknowns) and equations. Interpretation would be analogous to that presented. The aid of an electronic computer would be desirable in many instances to ease the computation load.

FARM INCOME—A CONFUSED PICTURE

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T HE level of income received by farmers has been of considerable interest in recent years.[2] Both total farm income and average income of farmers have declined since 1951. Unfortunately, popular understanding of the farm income situation is not very complete, even among many farmers. The misconceptions involved are often reflected in legislation. When this happens the basic intention of the legislation is imperfectly accomplished.

Much of the confusion concerning farm income has been encouraged by general but uncritical use of rather complex data. It is the purpose of this article to encourage a better understanding of several facets of farm income and to offer one specific suggestion which we believe would be of considerable value in alleviating misunderstanding, especially for policy purposes. We propose to examine closely some of the measures used and what they do or do not measure. The discussion centers around gross and net income to agriculture, and measures of income per capita and per farm.

The first portion of this paper deals with over-all measures and averages of income received by farmers under the current census definition of "farms" as an identifiable sector of the economy. A later section points out fallacies in this concept, particularly as long as we continue to use the current census definition of a "farm."

Sources of Income to Farmers

One source of misunderstanding concerning the income situation in agriculture is the choice of terms by which income is designated and the fact that such terms are often used synonomously when they are not the same. For example, "farm income" and "income received by farmers" sound basically the same. They are not the same at all. Technically, farm

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[1] The author wishes to acknowledge the helpful criticism of Geoffrey Shepherd, Iowa State College, and Bill Bolton, M. D. Woodin, and J. P. Montgomery, Louisiana State University.

[2] "Development of Agriculture's Human Resources"—Report prepared for the Secretary of Agriculture, U.S.D.A., April, 1955. "The Low-Income Farm Problem," Proceedings Issue, *Journal of Farm Economics*, December, 1955. "Low-Income Areas in Agriculture," Proceedings Issue, *Journal of Farm Economics*, December, 1954. "The Low Farm Income Problem," *Farm Policy Forum*, Spring, 1956. "Low Production Farms," by Jackson V. McElveen and Kenneth L. Bachman, Agriculture Information Bulletin No. 108, U.S.D.A., June, 1953.

Of more importance, perhaps, is the treatment commonly found in various popular magazines and newspapers.

income means income derived from the farm. This includes cash receipts from marketings, nonmoney income, and government payments.[3]

Income received by farmers means income derived from all sources. This includes nonagricultural sources of income. Such sources include investments made off the farm and income received for off-farm work. Income to farmers from nonagricultural sources increased from 1.9 billion dollars in 1934 to 6.1 billion dollars in 1955. Nonagricultural income represented 15.9 percent of the gross income and 33 percent of the net income received by farmers in 1955. When reference is made to "farm income" as though it represents all income received by farmers then actual income is understated.

Choice of Base Period

Another source of difficulty in understanding the farm income situation has to do with the year or period of time (base period) with which comparisons are to be made. The same income data can be made to appear good or bad by the choice of the base period.

If we choose the very worst year (or period) as a base then all other years look good as compared with this base. If we choose the very best year (or period) then all other years (or periods) look bad in comparison. A common use of indexes is for the purpose of comparing income data for different segments of the economy. Since changes in incomes differ among groups over the years one is always in a more or less favorable position, incomewise, with respect to another. For some purposes it often appears desirable for one group to state its income position at a relatively poor level as compared with another. When this is true there is always the tendency to choose a base period to suit the situation.

Table 1 shows data that lead to different conclusions depending on the base used. Per capita income of the farm and nonfarm population for 1955 is measured from two different base periods. Per capita income of farmers in 1955 was 3.51 times as great as the average for 1935-39; for nonfarmers 3.26 times as great. When measured in terms of the 1947-49 base, however, per capita income of the farm population only increased by 4 percent while that of the nonfarm population increased by 31 percent. The conclusions differ depending on the base used. The per capita income of the farm population has increased most since 1935-39, but per capita nonfarm incomes have enjoyed the greatest relative increase since 1947-49.[4]

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[3] Nonmoney income refers to such things as foods (milk, eggs, vegetables) and rent which are furnished by the farm and would otherwise have to be purchased. Government payments are payments made to farmers for such things as improved conservation practices.

[4] The absolute difference in per capita farm and nonfarm income is still another problem. During 1947-49 average income per capita of the farm population was 58

TABLE 1. INCOME IN 1955 AS A PERCENT OF INCOME IN SELECTED BASE PERIODS

Base period	Income per capita of the farm population	Income per capita of nonfarm population
	Percent	Percent
1935–39 = 100	351	326
1947–49 = 100	104	131

Source: *Farm Income Situation*, July 17, 1956.

Our discussion of average total and per capita income received by all farmers uses 1951 as a base.[5] Ordinarily, it is not a good procedure to use one year as a basis for comparison. Too many factors can cause a single year to differ greatly from an average. Also, in many respects 1951 was a particularly favorable year (the peak year for per capita income of the farm population) for agriculture. However, 1951 is used here because it appears to have been a major and persistent turning point in the relationship between per capita income of the farm and nonfarm population (Figure 1). More important, most of the recent discussions concerning farmers' income have used 1951 as a basis for comparisons. Having increased with per capita nonfarm income for a number of years, per capita income of farmers turned decidedly down for the second time in 1951 (the first decline was in 1948) while income measures of most other sectors of the economy continued increasing.

Gross Farm Income

Part of the misconception surrounding the farm income situation can be traced to the tendency to look at total income without reference to decreases taking place in farm population and farm numbers. Gross farm income (cash receipts plus nonmoney income plus government payments) reached a peak of 38.4 billion dollars in 1951 (Table 2). By 1955 it had declined to 33.2 billion dollars, a decrease of more than 5 billion dollars. That is a lot of money—percentagewise it represents a decrease of 13.3 percent in gross farm income. But, farm population also decreased during this period, from about 24 million persons in 1951 to 22 million in 1955 (a decrease of about 8.3 percent). Taking this into consideration, gross farm income per capita of the farm population is shown to have

percent of that for the nonfarm population. This disparity increased so that in 1955 per capita farm income was only 46 percent of per capita nonfarm income. The degree of disparity is considered by some students of the problem to be somewhat less than is indicated by the absolute data. Detailed discussions on this point may be found in Geoffrey Shepherd's *Agricultural Price and Income Policy*, 1952, pages 30-34, and in the studies to which he refers.

[5] All farmers as currently defined. The period 1947-49 also has been considered as a favorable period for agriculture. Some comparisons are also made which use this period as a base.

decreased by about 5.5 percent from 1951 through 1955. This is still a percentage decrease, but less than half as large as the original figure would indicate. On a per capita basis gross farm income did not decrease as much as gross farm income data alone would indicate.

If gross farm income in 1955 is compared with the average for 1947-49 ($33,134,000,000), the result (index = 100.4) would indicate substantially no change from the average for that period while per capita farm income rose 4 percent.

Average per capita net income of the farm and non-farm population, U. S., 1934-55
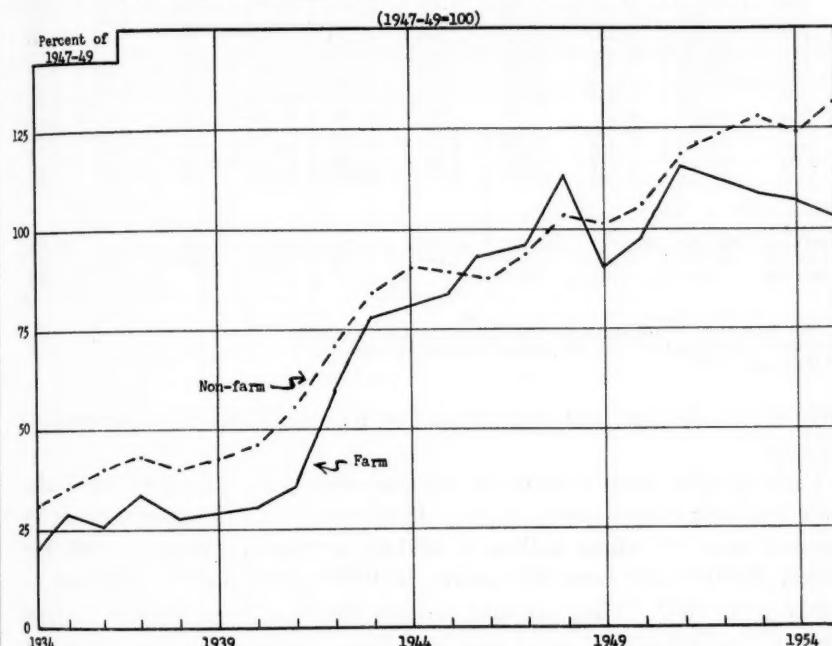
FIGURE 1

Net Farm Income and Net Income Received by Farmers

Net farm income is of more significance to farmers than gross farm income since it represents income remaining after production costs have been met. Total production expenses declined from 22.3 billion dollars in 1951 to 21.6 billion dollars in 1955 (Table 2).[6] Subtracting costs from gross returns we find net income from farming declined from about 16.1 billion dollars in 1951 to 11.7 billion dollars in 1955—a decrease of 27.5 percent. However, this figure also neglects certain related data, particu-

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[6] Production costs include operating expenses, consumption of farm capital, taxes, and interest.

TABLE 2. INCOME RECEIVED BY THE FARM POPULATION

Year	Gross and net income of farm operators, from farming			Net income of the farm population		Farm population	Net income per capita of the farm population	Operators' net cash income per farm	Average annual farm income per worker in agriculture
	Gross farm income[1]	Production expenses	Net farm income	Net non-farm income	Net income from all sources[2]				
	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars	(1,000)	Dollars	Dollars	Dollars
1940	$11,319	$ 6,749	$ 4,570	$2,700	$ 7,999	30,547	$262	$ 386	$ 484
1941	14,248	7,675	6,573	3,100	10,555	30,273	349	611	604
1942	19,866	9,942	9,924	3,800	14,874	29,234	509	1,076	995
1943	23,309	11,487	11,822	4,200	17,448	26,681	654	1,569	1,331
1944	24,002	12,195	11,807	4,400	17,752	25,495	696	1,561	1,411
1945	25,333	12,922	12,411	4,200	18,221	25,295	720	1,604	1,515
1946	29,247	14,324	14,923	4,300	21,021	26,483	793	1,822	1,704
1947	32,289	16,831	15,458	4,900	22,283	27,124	822	2,041	1,926
1948	36,338	18,643	17,695	5,100	24,804	25,903	958	1,752	1,829
1949	30,775	17,909	12,866	5,200	19,851	25,954	765	1,487	1,660
1950	32,964	19,248	13,716	5,300	20,759	25,058	828	1,435	1,671
1951	38,369	22,258	16,111	5,600	23,603	24,160	977	1,741	1,974
1952	37,596	22,476	15,120	6,100	23,144	24,283	953	1,788	1,968
1953	34,509	21,246	13,263	6,000	21,094	22,679	930	1,812	1,943
1954	33,929	21,442	12,487	5,700	19,939	33,929	911	1,629	1,743
1955	33,279	21,599	11,680	6,100	19,529	22,158	881	1,538	1,711
Base period averages:									
1947-49	$33,134	$17,794	$15,339	$5,066	$22,312	26,327	$848	$1,760	$1,805
1935-39	10,659	5,744	4,915	2,320	7,891	31,396	251	740	471
1910-14	7,728	3,789	3,939	[3]	[3]	32,197	[3]	612	338

Source: *The Farm Income Situation*, July 17, 1956.
[1] Includes government payments and estimated value of farm perquisites.
[2] Includes government payments and wages of resident farm workers.
[3] Data not available.

larly the decline in farm population and increased income from nonfarm sources.

Farm people have sources of income other than farming. Some also have nonfarm employment. Income to farmers from nonfarm sources increased from 5.6 billion dollars in 1951 to 6.1 billion dollars in 1955. The added $500,000,000 from this source in 1955 represented a 9 percent increase over 1951. When we add income from nonfarm sources to farm income (including wages of resident farm workers) we find that net income to the farm population, from all sources, declined from 23.6 billion dollars in 1951 to 19.5 billion in 1955 or a decrease of 17.2 percent. (This decrease was 12.5 percent from the 1947-49 average.)

The nearly 2-million-person decline in farm population from 1951 through 1955 is about 8.3 percent for the period. We can determine average net income per capita of the farm population by dividing net income from all sources by farm population. Net per capita income decreased from $977 in 1951 to $881 in 1955, or 9.8 percent. (This was an increase of 3.9 percent for 1955 from the 1947-49 average of $848.)

Other measures of farm income include "operators' net cash income" and "average annual farm income per worker" (Table 2). Operators' net cash income (cash income per farm minus cash expenses) was $1,741 in

Average
annual
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worker
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culture

Dollars

$ 484
694
995
1,331
1,411
1,515
1,704
1,926
1,829
1,660
1,671
1,974
1,968
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1951 and $1,538 in 1955, a decrease of 11.7 percent. Average annual farm income per worker[7] decreased from $1,971 in 1951 to $1,711 in 1955 or a decrease of 11.5 percent. (This was a decrease of 5.2 percent from the 1947-49 average.)

There is no question that income received by farmers has declined since the peak year 1951. How much it has declined depends on what is included and the measures used. If we use "net farm income" alone the decrease was 27.5 percent. If we allow for nonfarm income and farm population changes then net income per capita of the farm population decreased by 9.8 percent from 1951 to 1955. Both of these figures register a decrease in farmers' income. But there is a considerable difference between them. Further, if the comparison is made in terms of 1947-49, a good period, rather than 1951, the peak year, then again there is a considerable difference.

What is a Farm?

Any logical discussion of the farm income situation must, in the final analysis, be based on the individual farm. This necessarily brings up the question—what is a farm?[8] While the answer is not an easy one it is possible to make some delineation.

The Censuses of 1950 and 1954 use the following definition of a farm: ". . . places of 3 or more acres were counted as farms if the annual value of agricultural products, exclusive of home-garden products, amounted to $150 or more. The agricultural products could have been either for home use or for sale. Places of less than 3 acres were counted as farms only if the annual value of sales of agricultural products amounted to $150 or more."

This means that anyone with two pecan trees, in a good year, may qualify as a farmer. Five 100-foot rows of carrots, harvested and sold from a roadside stand, constitutes a "farm." Five good hogs, fattened in a pen in the back yard and sold, automatically makes one a farmer. If one owns 3 acres or more and a cow and consumes the milk at home, he is a farmer. Or, if one owns 3 acres and a flock of 16 hens producing about 330 dozen eggs per year, mostly consumed at home, he is automatically a farmer.

The definition of a "farm" above is basic to much of the misunderstanding concerning farm income. In 1954 there were 4.8 million land holdings (Table 4) that qualified as farms under the definition. It should be very obvious that many of these farms are farms by definition only. The data following will demonstrate this.

[7] Net income of farm operators from farming plus farm wages, divided by the average number of persons working (operator, family, and hired labor).
[8] The question has arisen before. For example, see Kirk Fox, "What is a Farmer?," *Farm Policy Forum*, August, 1950.

Distribution of Income within Agriculture

Thus far we have been discussing some rather broad averages. This was done in order to increase our understanding of the differences in statistical series that consider the general farm income picture as a whole. But these data still leave a large gap in our understanding. We need to go further in our discussion and study the distribution of income among farmers.

A major weakness of data which treats all farms alike is the fact that all farms are not alike. This is particularly true in terms of income. For example, in Table 2 we find net cash income per farm was $1,538 in 1955. Obviously, there were many farms with lower net cash incomes in 1955 and also many with higher net cash incomes. This figure does not tell us very much about the true picture of net cash income per farm in 1955. This is a common difficulty when we try to group too many different things together under one heading, which we usually name "average." Data are available, however, to break down some over-all averages into component parts which yield much more information about farm income.

Too often the expression is used "the average farmer" or "the average farm." There is no such person or farm. This is particularly true in terms of farm income. Individual farm incomes differ widely for many reasons. To include all farms together under a single category such as "average net income per farm" can be highly misleading. Table 3 shows

TABLE 3. THE DISTRIBUTION OF FARMS BY ECONOMIC CLASS, UNITED STATES, 1949

	Number in class	Percent in class	Value of farm products sold	Percent of of sales	Average sales per farm
Total number of farms	5,379,250	100	$22,279,562,599	100	$ 4,142
Farms by economic class:					
Commercial: (Volume of sales)	3,706,412	68.9	$21,713,216,602	97.5	$ 5,858
I. $25,000 or more	103,231	1.9	$ 5,786,964,265	26.0	$56,058
II. $10,000–24,999	381,151	7.1	$ 5,517,034,144	24.8	$14,475
III. $ 5,000–9,999	721,211	13.4	$ 5,060,528,547	22.7	$ 7,017
IV. $ 2,500–4,999	882,302	16.4	$ 3,198,160,839	14.4	$ 3,625
Cumulative percent	38.8			87.9	
V. $ 1,200–2,499	901,316	16.8	$ 1,634,395,317	7.3	$ 1,813
VI. $ 250–1,199[1]	717,201	13.3	$ 516,133,490	2.3	$ 720
Cumulative percent	68.9			97.5	
Other:	1,672,838	31.1	$ 566,345,997	2.5	$ 339
Part-time[2]	639,230	11.9	$ 391,193,954	1.7	$ 612
Residential[3]	1,029,392	19.1	$ 84,714,797	.4	$ 82
Abnormal[4]	4,216		$ 90,437,246	.4	$21,451

Source: *Census of Agriculture,* 1950.

[1] Provided the farm operator worked off the farm less than 100 days, or provided the income of the farm operator and members of his family received from nonfarm sources was less than the value of all farm products sold.

[2] Farms with a value of sales of farm products of $250 to $1,199 were classified as part-time if the farm operator reported (a) 100 or more days of work off the farm in 1954, or (b) the non-farm income received by him and members of his family was greater than the value of farm products sold.

[3] Residential farms include all farms except abnormal farms with a total value of sales of farm products of less than $250.

[4] Insofar as it was possible to identify them, abnormal farms include public and private institutional farms, community enterprises, experiment station farms, grazing associations, etc.

farms as grouped by 1949 farm incomes[9] in the 1950 Census. It is immediately apparent that individual farm incomes vary widely. It is also obvious that many "farms" are farms in name only. The table shows that, insofar as income is concerned, the "average farm" is a major misnomer.

Nearly one-third (the 31.1 percent under "other") of the holdings classified as farms are not farms at all. The "Other" classification includes "Part-time" farms for which agricultural income makes up a minor portion of the total income of the farm family. It also includes many "Residential" farms which are really country residences. Together, these two "farm" groups made up 31 percent of the number of farms in 1949. But their gross farm sales amounted to no more than 2.5 percent of all sales of agricultural products. Many of these "farms" are not farms at all. Yet, in any computation of average farm income, either total or per farm these units are included. They were included, for example, in determining that net cash income per farm in 1955 was $1,538 (Table 2). Since average gross income for these two groups in 1949 was only $339 it is obvious that including them distorts the picture of average farm income as it applies to real farms.

Commercial Farms

This brings us to a consideration of the farms classified by the Census as Commercial farms (Table 3). Commercial farms in 1949 made up 68.9 percent of the total number of farms but they accounted for 97.5 percent of gross sales of agricultural products. However, even among farms classified as Commercial (farms deriving their main income from agriculture), there are considerable differences, as indicated here by differences in farm income. Average income per farm from sales of agricultural products in 1949 varied from $82 for residential farms to $56,058 for farms in Class I. Farms in Classes I-IV made up about 39 percent of all farms in 1949. But they accounted for 88 percent of all sales.

The average sales per farm by economic classes, as shown here, tells us much more about the farm income situation than does the simple average that is usually quoted which includes all farms. According to these data average income per farm from sales of agricultural products in 1949 amounted to $4,142. But, as noted earlier, the average income by classes varied from $826 to $56,058. This is indeed a wide difference and emphasizes the inaccuracy of simple, all inclusive averages.

Commercial farms in Classes I through IV, about 2 million of them, make up the core and substance of our agriculture. In these four groups also we find the real "family farms"—farms operated primarily with family labor and under family management. The large majority of these farms, under good management, are capable of furnishing the farm family

[9] These data do not include income received from nonagricultural sources.

with a reasonably good standard of living or better.[10] Farms in Classes V and VI, while still essentially farms, and deriving a major portion of income from agriculture, often do not have the resources and management needed to furnish a good standard of living for the farm family. These are the farms often designated as "low income" farms. They included 30.1 percent of the farms in 1950 but accounted for only 9.6 percent of agricultural sales. Average income per farm in 1950 was $1,813 for Class V farms and $720 for Class VI farms. Many farms in Class VI are, literally, subsistence farms, often barely providing the necessities for life.

The distribution of farm income within the Commercial Class is

TABLE 4. FARMS BY ECONOMIC CLASS, UNITED STATES, 1949 AND 1954

	1949		1954	
	Number in class	Percent in class	Number in class	Percent in class
Total number farms	5,379,250	100	4,782,963	100
Farms by economic class:				
Commercial:	3,706,412	68.9	3,326,675	69.6
(Volume of sales)				
I. $25,000 or more	103,231	1.9	134,041	2.8
II. $10,000–24,999	381,151	7.1	448,771	9.4
III. $ 5,000–9,999	721,211	13.4	706,680	14.8
IV. $ 2,500–4,999	882,302	16.4	811,482	17.0
	Cumulative percent	38.8		44.0
V. $ 1,200–2,499	901,316	16.8	763,259	16.0
VI. $ 250–1,999	717,201	13.3	462,442	9.7
Other:	1,672,838	31.1	1,456,288	30.4
Part-time	639,230	11.9	574,579	12.0
Residential	1,029,392	19.1	879,094	18.4
Abnormal	4,216	—	2,615	—

Source: *Census of Agriculture*, 1950 and 1955.

improving. As shown in Table 4 the number of farms in Classes I, II, III, and IV increased from 38.8 percent in 1949 to 44 percent through 1954.

[10] There could well be some question as to just what constitutes a "reasonably good' standard of living. This could be the topic for another paper or the basis for a research project, either of which is outside the scope of this presentation. However, the current "dollar" level of living would be somewhat higher than is indicated in Table 3 for any particular class since, as noted earlier, these income data do not include nonfarm income. (Nonfarm income was 15.9 percent of the gross and 33 percent of the net income received by farmers in 1955). This problem of "standard of living" is related to the discussions already cited in footnote 4. Many of the farms in Classes III and IV could further improve their gross and net farm incomes through better organization and management. Nonetheless as farm costs increase the net income needed to provide a "reasonably good" standard of living must increase also.

The number in the lower income groups, Classes V and VI, declined—from 30.1 percent to 25.7 percent. Thus, over time, a greater percentage of farms are obtaining farm incomes which move them into higher income classifications.

By letting the total number of Commercial farms equal 100 (i.e., leaving the "Other" farm group out of the calculations) our data become an even more accurate representation of farm income among those farms contributing most to agricultural production and sales (Table 5). In 1954 over half (63.1 per cent) of the commercial farms were in Economic Classes I through IV where income per farm from agricultural sources alone was above $2,500 (this was 56 percent in 1949). Thirty-nine percent of the commercial farms (groups I-III had average farm incomes alone above $5,000 in 1954 (this was 33 percent in 1949).

TABLE 5. COMMERCIAL FARMS, UNITED STATES, 1949 AND 1954

	1949		1954	
	Number	Percent	Number	Percent
Commercial farms: (Volume of sales)	3,706,412	100	3,326,675	100
I. $25,000 or more	103,231	2.8	134,041	4.0
II. $10,000–24,999	381,151	10.3	448,771	13.5
III. $ 5,000–9,999	721,211	19.4	706,680	21.2
IV. $ 2,500–4,999	882,302	23.8	811,482	24.4
	Cumulative percent	56.3		63.1
V. $ 1,200–2,499	901,316	24.3	763,259	22.3
VI. $ 250–1,199	717,201	19.4	462,442	13.9

Source: *Census of Agriculture*, 1950 and 1955.

Income Policy and New Programs

Our examination of farm income data should emphasize two important points, each closely related to the other. First, it should be obvious that terms such as "average farm income" can be greatly misleading when applied across the board to all "farms." The second is that agricultural policy and programs, particularly those with income objectives, need to be designed for and aimed at specific groups.

As a specific example we might cite our agricultural price support programs. A major portion of agricultural expenditures over the past thirty years has gone into these programs. Ultimately, it is higher farm incomes, and not prices, that provide the real objective for the price programs. Yet it should be perfectly obvious from the data shown above that price supports can do little to help the incomes of farmers who fall in income Classes V and VI. Yet, also, it is precisely because these and "Other" farms are included in determining "average farm income" that

the average is so low as to indicate a need for legislation aimed at raising "average farm income." This leads us, again, to the conclusion that specific policies to alleviate specific ills in the farm income picture need to be directed to specific groups.

There is some indication that the "average farmer" is finally being recognized as a myth. Two programs have gotten underway recently which show some promise of fitting the right shoe to the right foot. One is the Farm and Home Development Program. This is an extension teaching program, aimed primarily at commercial family farms. It is designed to improve management practices in order to improve the income of farmers whose primary source of income and employment is the farm.

The second program, put into effect experimentally in the fall of 1956, is called Rural Development. This program is designed particularly for commercial farmers falling in groups V and VI. There is also provision made for work with part-time "farms." The program will attempt to increase, reorganize or redirect the resources of low-income farmers in order to raise their incomes. Where the famer's major limitation is capital, land, or similar resources, attempts will be made to increase them. Where resources are adequate but poorly organized or managed, attempts will be made to improve organization through better management.

Some farmers will be shown that their best alternative to increase family income, all things considered, is to change from farming to industrial or other employment. Such a move will be facilitated. One objective of Rural Development is to bring in small industries, wherever possible, to absorb the excess farm labor resource. This does not mean, as is often heard, the dissolution of the family farm. Such a statement is, of course, patently incorrect. There is nothing to show that the rigors of subsistence levels of living in rural areas contributes much either to democratic ideals or practices. It does mean that, where it is possible, some low income farmers will be aided in obtaining and organizing resources to provide an income more nearly in keeping with the family farm ideal.

Toward a Clearer Concept of the Farm Income Problem

The problems of agriculture are many and varied. A logical attack on any kind of problem requires that all the pertinent data be clear-cut so that all aspects of the problem can be clearly defined. A major purpose of classification and statistical separation of data is to facilitate delineation of problems so they can be solved. Progress is being made in this direction. Still, much remains to be done.

Our discussion has shown that much misunderstanding of the farm income situation may be brought about by lack of understanding and

misuse of available data. It may also result from inadequate classifications of data. If a more reasonable definition of a farm could be devised it would be of considerable help in formulating effective farm policies and programs, particularly those relating to income.

Changes are also needed in the economic classification of farms. "Farms" which currently qualify as such under the "Other" classification of the Census, should not be included in any general statistical average of income data pertaining to agriculture. Most of them are not farms according to any reasonable interpretation of the term. Their inclusion obscures the picture for those that are. Making up 31.1 percent of the total number of "farms" their contribution to agricultural sales was only 2.5 percent of the total in 1949. These "farms" make unrealistic the averages of which they become a part.

For most purposes, Residential and Abnormal farms should not be considered a part of agriculture at all. Part-time "farms" should be considered as a special category and in a limited sense in certain policies and programs where it may appear logical to include them as a part of agriculture.

This leaves the main body of real farms, Classes I-VI (holdings on which the major income is derived from farming), to be designated and treated, statistically and in policy and programs, as farms. Even within the Commercial class, however, a change is needed to distinguish between low-income and subsistence farms (Classes V and VI) and the farms that make up the real core of U. S. agriculture, Classes I-IV. The low-income groups are a special problem, both for agriculture and the general economy.

The Census classification should be changed so that only those farms currently in Economic Classes I through IV be designated as Commercial farms. Farms now classified in Economic Classes V and VI should be given some other, special, designation. Subsequently, statistical data (averages, etc.), policies and programs should always be spelled out as far as possible as to which of these specific classifications they apply.

The development and general use of better farm classifications would help to eliminate much of the emotionalism and misunderstanding over farm income. It would help to promote policies and programs having a greater promise of success in the solution of "the income problem" of agriculture.

NOTES

RESOURCE ADJUSTMENTS ON 146 COMMERCIAL CORN-BELT FARMS 1936-1953

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C URRENT emphasis on resource maladjustments connected with low-income agriculture may obscure recognition of the possibility that inefficiencies also occur on highly developed commercial farms. Admittedly, the effect of any inefficiencies on these farms would not be serious in terms of most criteria relative to personal income distribution. Nonetheless, deviations from the efficiency norm may be pronounced in highly developed commercial areas. This note presents the results of a study of resource adjustments on 146 north-central Illinois farms on which farm accounts were kept during the period 1936-39.

If exact correspondence could be established between available input data and their empirical counterparts, profit-maximizing competitive firms would, under "riskless" production conditions, equate the marginal value productivity of each resource category to its cost. Rather than using such an equilibrium as a norm, we might assume that the pre-World War II years 1936-39 represent a reasonably good *degree* of adjustment. We then pose the following question: Were there significant departures in the degree of resource adjustment in 1950-53 as compared with the adjustment that obtained in the pre-World War II years 1936-39?

To investigate this question, production functions (linear in the logarithms of the variables) were fitted for the years 1936 through 1939 and for 1950 through 1953. The dependent variable, *value of product,* is defined as gross sales adjusted for inventory changes. *Land investment* was measured by using a soil productivity index to adjust the average Illinois land values for the particular year considered. Thus a consistent method of valuation among farms and through the period was maintained. *Buildings and soil improvements* category represents investment at beginning of year in buildings and estimated remaining value of such soil improvements as limestone and rock phosphate. *Livestock investment* is value of inventory on January 1. *Labor,* as reported in the farmer's records, includes market value of labor performed by the operator and his family, and hired workers. *Power and machinery inputs* are on an annual basis, that is, they include gas and oil, depreciation, and minor repairs. *Purchased feed* includes the value of all livestock feed purchased for consumption on the particular farm.

The estimated elasticities of production for each of these six resource categories in the period 1936-39 and 1950-53 are presented in Table 1.

A one-percent increase in each of these inputs is estimated to increase value of product by the amount indicated; e.g. in 1936-39 a one-percent increase in land investment would have resulted in a .292 percent increase in the value of product.

TABLE 1. ELASTICITIES OF PRODUCTION: 146 NORTH-CENTRAL ILLINOIS FARMS, 1936–39 AND 1950–53[a]

Resource

Years	Land investment	Buildings and soil improvements investment	Livestock investment	Labor	Power and machinery inputs	Purchased feed
1936–39	.292 (.042)	.133 (.025)	.027 (.022)	.511 (.054)	.024 (.021)	.086 (.012)
1950–53	.410 (.036)	.032 (.017)	− .010 (.016)	.304 (.040)	.137 (.038)	.166 (.012)

[a] Standard errors of regression coefficients are in parentheses under their respective coefficients.

The elasticities necessary in 1950-53 for an additional dollar in each of these resources to have earned the same return that an additional dollar of the same resource earned in 1936-39 are given in Table 2.

TABLE 2. ELASTICITIES OF PRODUCTION IN 1950–53 TO EQUALIZE MARGINAL RATES OF RETURN PER DOLLAR INVESTED BETWEEN 1936–39 AND 1950–53

Land investment	Buildings and soil improvement investment	Livestock investment	Labor	Power and machinery	Purchased feed
.254	.081	.030	.515	.045	.146

Application of significance tests[1] to the difference between each of these computed coefficients and their respective actual values in 1950-53 (Table 1) indicates significant differences (one-percent level) for the categories of land and labor. No other resource exhibited a difference in adjustment between time periods significant at less than the 10-percent probability level.

Since, in order to equate 1950-53 marginal returns on land investment to the 1936-39 level, a lower elasticity is needed in 1950-53 than that which actually obtained, the pressure for larger farms is indicated. The opposite is true for labor; a higher elasticity is needed in 1950-53 to

[1] For test employed see Earl O. Heady and Russell Shaw, "Resource Returns and Productivity Coefficients in Selected Farming Areas," *Journal of Farm Economics*, 36:250-251, May 1954.

restore 1936-39 "equilibrium." If the 1936-39 period is accepted as one of reasonably good adjustment, the intervening years have apparently disturbed land and labor adjustments on these farms to a greater degree than in case of the other resources.

In interpreting the generality of these results, the characteristics of these farms need to be examined. Changes in the quantities of resources used during the period on these account-keeping farms vary considerably from the average changes for all farms in the counties[2] in which the farms are located. From 1935 to 1954 the average size of farm in these counties increased from 162 to 194 acres or an increase of 19 percent. The average acreage of the 146 farms in the period 1936-39 was 275 acres; in 1950-53, 288 acres, or an increase of only five percent. Labor per farm increased about six percent on the average in these counties during the period 1935-1954. (Dates of enumeration in the 1935 Census were different from those of the 1955 Census making this comparison between years somewhat inaccurate.) Operator labor, family labor and hired labor per farm reported on the 146 farms decreased slightly less than three percent during the period 1936 to 1953. The farms remained essentially two-man units in terms of labor reported. The 146 farms increased their volume of business by adding livestock during the period. In comparing the average quantity in 1936-1939 with the average quantity in 1950-1953 we find an increase of physical inventories on January 1 of 37 percent. The average increase for all farms in the area was, however, much greater. Cattle on hand per farm on January 1 increased 72 percent during the same period when all farms in the area are considered; hog numbers per farm on all farms increased 88 percent.

With high incomes during World War II and with the opportunity to build up savings, farmers who were rather well established at the beginning of the period may have achieved satisfactory levels of living and had little incentive to expand. Although management of a few of these farm units had been passed on to younger persons, the bulk of these farms had continuous management by the same person over the 18 years. In view of the larger initial farm size of account-keeping farms it is not surprising that these farms failed to grow at the same rate as other farms in the area.

At least part of the drop in the marginal value productivity of labor in relation to its cost is likely to be due to the changing nature of labor data reported. Labor is reported in terms of months and record keepers are apt to report in terms of labor available, instead of labor actually

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[2] Bureau, Coles, DeKalb, DeWitt, Douglas, Edgar, Ford, Iroquois, LaSalle, Lee, Livingston, Macon, McLean, Tazewell, Vermilion and Woodford.

utilized. Due to the increased mechanization during the 18-year period, not only has the discrepancy between labor available and labor used probably increased, but also the physical effort as well as length of day has probably diminished.

Strict adherence to the norm of efficiency in resource use would probably indicate that adjustments are needed in farm size (acreage) and/or labor per farm. However, the average level of income on these farms is such (average cash balance 1950-53: $12,047) that income incentives are not strong for labor adjustment.

ARE LAND PRICES TOO HIGH: A NOTE ON BEHAVIOR IN THE LAND MARKET

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IN A RECENT article Marc Nerlove[1] focuses attention on the possibility of predicting acreage responses in terms of expected prices, where expected price is a declining weighted average of past prices. In this note the weighting principles underlying expectation models are used in developing an aggregate theory of behavior in the land market.

The insight upon which the following equations are built stems from the common practice to rent agricultural land on the basis of a specified share of realized gross or net returns. Particularly noteworthy is the tendency for this share to remain a constant over time in spite of wide fluctuations in receipts.

D. Gale Johnson has, "by assuming that the net rent on rented land would bear the same relationship to the total net return on all land as the value of rented land did to the value of all land for each year,"[2] estimated the return to land as a per cent of agricultural income for the years 1910 to 1946. In spite of a significant downward trend[3] the coefficient of variation for this percentage is only 6.9%.

The constancy of this proportion suggests the theory that the market tends to capitalize a certain proportion of expected net farm income into land values. Provided net income is proportionately related to gross

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* I am indebted to Professor D. Gale Johnson for his helpful criticisms and suggestions.

[1] Marc Nerlove, "Elasticities of Selected Agricultural Commodities," *Journal of Farm Economics*, XXXVIII (May, 1956), pp. 496-509.

[2] D. Gale Johnson, "Allocation of Agricultural Income," *Journal of Farm Economics*, XXX, No. 4 (November, 1948), p. 728.

[3] Least squares relation, where: X_1 = return to land as a per cent of total net income from agriculture, 1910-46; and X_2 = years, 1-37. $X_1 = 34.9 - .202X_2$ $\bar{R}^2 = .334$

farm income, gross[4] income can be substituted for net farm income. In an endeavor to test variants of the theory that gross farm income can be used to predict land values, the following models were constructed using time series data.

Model 1

X_1 = value of land and buildings per acre, 1912–14 = 100, U.S., 1920–53[5]

X_2 = gross farm income (including government payments)[6] per harvested acre[7] lagged one year.

X_3 = five year moving average of gross farm income (including government payments) per harvested acre lagged one year.

X_4 = expected gross farm income (including government payments) per harvested acre, where expected gross farm income is a weighted[8] function of gross income in the preceding ten years.

$$(1) \qquad\qquad X_1 = 58.7 + .134X_2 \qquad R^2 = .72$$

$$(2) \qquad\qquad X_1 = 48.4 + .169X_3 \qquad R^2 = .79$$

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[4] The desirability of using gross farm income as a variable rather than some concept of net returns to land stems from the abundance of relatively reliable data on gross income and the fact that any net allocation of gross income to land must necessarily be based upon rather arbitrary assumptions. The existence of family owned and operated farms makes a clear-cut distinction between returns to land, labor and capital impossible.

[5] U. S. Agricultural Research Service, *The Farm Real Estate Market* (Washington: United States Department of Agriculture, November 1955), p. 8.

[6] United States Department of Agriculture, *Agricultural Statistics: 1954* (Washington: Government Printing Office, 1954), p. 428.

[7] *Ibid*, p. 448.

[8] The smallness of the coefficient of expectation (.2052) derived from the regression of last year's price of land and last year's gross income on this year's price of land made it expedient to use only 89.94% of the implied weights which are as follows:

$X_{1t-1} = .2052$ $\qquad X_{1t-2} = .1631$ $\qquad X_{1t-3} = .1296$ $\qquad X_{1t-4} = .1030$ $\qquad X_{1t-5} = .0819$

$X_{1t-6} = .0651$ $\qquad X_{1t-7} = .0517$ $\qquad X_{1t-8} = .0411$ $\qquad X_{1t-9} = .0327$ $\qquad X_{1t-10} = .0260$

The parameter estimates of equation (3) can be derived from a direct transformation of the lagged coefficients in the relation $X_{11} = \&_0 + \&_1 X_{1t-1} + \&_2 X_{2t-1}$. For the 39 observations, 1913–52:

$$X_{1t} = 7.3 + .795X_{1t-1} + .048X_{2t-1} \qquad R^2 = .9559$$

Transforming to get the parameters in Model 1, (3) directly:

$$B(\text{coefficient of expectation}) =_1 - \&_1; \quad \&_0' = \frac{\&_0}{B} ; \quad \&_1' = \frac{\&_2}{B}$$

$$(3)'' \qquad\qquad X_1 = 35.58 + .2152X_4$$

The difference in parameter estimates in (3) and (3)'' can be attributed to ignoring some of the implied weights. Note that most of the difference shows up in the constant term.

If one's primary purpose were to predict agricultural land values, $X_{1t} = \&_0 + \&_1 X_{1t-1} + \&_2 X_{2t-1}$ might well rank as one of the better two variable models, excelled perhaps only by the equation from which you get a coefficient of expectation for the theory that the price of agricultural land is a function of expected prices received for agricultural products. Where P_2 = prices received (1910-14 = 100), 1912-54.

$X_{1t} = .2 + .797X_{1t-1} + .173P_{2t-1} \qquad R^3 = .983$.

(3) $$X_1 = 42.9 + .207X_4 \qquad R^2 = .78$$

The important point to note with respect to Model 1 is that the per cent of the variance in land values explained can be increased by using a weighted average of past income rather than last year's income alone. Apparently when pricing future returns from land, the market takes a look at past returns in more than one year. The results of equations (2) and (3) are probably inconclusive with respect to determining whether a system of declining weights is preferable or not to a moving average in as much as 10.06% of the declining weights were not used in constructing X_4. Since approximately the same results were obtained with a loss of fewer degrees of freedom, a moving average may have considerable merit when the coefficient of expectation is low and the number of observations is limited.

An alternative formulation of expected income might be that expected farm income is a function of last year's prices received and this year's acreage; i.e., farmers modify their income expectations in terms of contemplated output adjustments.[9] The following variable was constructed as a crude check against such behavior:

X_5 = gross farm income (including government payments) per harvested acre in year t divided by prices received by farmers in year t times prices received by farmers[10] in year $t-1$.

(4) $$X_1 = 59.0 + .1315X_5 \qquad R^2 = .72$$

The unrounded unadjusted R^2 in equation (4) is slightly higher than in equation (1). For a rigorous test of the cobweb theory it would seem desirable to substitute planted acreage for harvested acreage, since acreage actually harvested may be influenced by weather and realized rather than expected prices.

Models 2 and 3 are essentially concerned with the addition of two variables, time and an interest rate, and the effects of modifying the form of our estimating equations.

Model 2

X_6 = farm mortgage rate.[11]
X_7 = 1, 2, $\cdots$ (years, 1-34)

(5) $$X_1 = 243.2 + \underset{(.028)--}{.344X_4} - \underset{(.500)}{3.102X_6} - \underset{(.148)}{5.134X_7} \qquad \bar{R}^2 = .972$$

In terms of the computed standard errors, all of the independent

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[9] This formulation was suggested by the cobweb theory of demand and supply response.

[10] Office of Statistical Standards, Bureau of the Budget, *Economic Indicators* (Washington: Government Printing Office, 1955), p. 53.

[11] D. Gale Johnson, *op. cit.* (for the years 1920-47), p. 747. *Agricultural Statistics: 1954, op. cit.* (for the years 1948-53), p. 498.

variables in Model 2 are highly significant.[12] The adjusted R^2 is so high that one has a tendency to suspect a spurious relationship, perhaps introduced by inflation. One also has a tendency to wonder about the appropriateness of an assumed linear relationship existing between land values and the interest rate. Present value as a function of the interest rate is not linear. As a check against such doubts estimates for the parameters in equations 6 and 7 were computed.

Model 3

$X_8 = X_1$ deflated.[13]
$X_9 = X_4$ deflated.[13]

$$(6) \quad X^2 = 104.6 + \underset{(.043)}{.308X_9} - \underset{(.563)}{1.108X_6} - \underset{(.516)}{2.381X_7} \quad R^2 = .784$$

(All variables are converted to logs in equation (7))

$$(7) \quad X_8 = 1227.9 + \underset{(.063)}{.878X_9} - \underset{(.152)}{.606X_6} - \underset{(.060)}{.578X_7} \quad R^2 = .911$$

The smaller R^2's in equations (6) and (7) suggest that inflation is in fact partly responsible for the low residual variance in equation (5). It is interesting to note that the assumption in equation (7) that all variables are linear in logs increases the proportion of total variance explained by 12.7% over equation (6) and increases the statistical significance of all independent variables.

The low residual variance particularly in equation (7) must imply that aggregation washes out a great deal of divergent micro behavior. One would suspect that the proportion of gross agricultural income allocated to land varies with respect to enterprises (some may be more capital and labor intensive than others) and differences in soil productivity. Speculative[14] price movements of either a local or regional character might also wash out in aggregation.

A more refined analysis of the aggregate land market would try to get

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[12] Very little is known about the exact sampling distribution of variables which are products of two or more other variables. The relevance of the t-test in testing the significance of the relation between gross income and land values is therefore in doubt.

[13] The deflator used was the purchasing power of the dollar as measured by the wholesale price index, 1935-39 = 100. Department of Commerce, *Survey of Current Business*, Vol. XXXII (June 1952), p. 24. It has been brought to my attention that the use of this deflator violates the presumption that the subject variables were in some "normal" state of relationship in the base period since it can be readily observed that land values were low in relation to commodity prices in 1935-39. A more complete analysis might well entail experimentation with other deflators such as the index of prices paid by farmers.

[14] From an analytical point of view, speculative forces might be conceived to be the result of derivative relations existing between variables within the model but not taken account of explicitly or the result of excluding variables from the model.

at the real forces responsible for trend. In a general way we know that the substitution of technology, fertilizer and mechanical power for nominal units of land has been responsible for a declining importance of agricultural land.[15]

In the last couple of years land values have continued to rise in spite of falling farm income.[16] The question has been raised: are land prices too high? According to the November 1955 issue of the *Farm Real Estate Market*:

"Last October, real estate reporters were asked whether they thought land prices were too high, about right, or too low in their areas considering present and expected levels of farm income and commodity prices. Although the distribution of replies varied widely in different areas, nearly half of the 6,300 reporters who replied thought land prices were too high, whereas only 8 per cent stated that they were too low.

"Even though reporters' opinions may not agree with those held by actual participants in the land market, they reveal a general awareness that land prices in many areas have advanced more than may be justified by current and prospective returns."[17]

A test of the null hypothesis that current land values are too high relative to historical relationships existing in the market can be made by comparing the price predicted by equations (5) - (7) with the actual index values for recent years. This comparison is made in Table 1.

TABLE 1

Year (March value)	Price of land predicted	USDA actual price of land	Deviation	Per cent deviation is of predicted
		Equation 5		
1954	214	216	2	00.9
1955	212	223	11	05.2
1956		232		
		Equation 6		
1954	95.0	102.4	7.4	7.8
1955	93.5	105.3	11.8	12.6
		Equation 7		
1954	98.3	102.4	6.2	6.4
1955	98.0	105.3	9.8	10.2

The results of Table 1 are not inconsistent with the null hypothesis that current land values are too high relative to historical relationships

[15] T. W. Schultz, *The Economic Organization of Agriculture* (New York: McGraw-Hill Book Co., 1953), p. 125.

[16] U. S. Agricultural Research Service, *The Farm Real Estate Market* (Washington: United States Department of Agriculture, March 1956), p. 4.

[17] *Ibid*, November 1955, p. 12.

existing in the market. From a purely statistical point of view, an assumption that trend is inoperative in 1954 and 1955 could account for a substantial part of the deviation between actual and predicted land values. Such an assumption, however, is probably not realistic. One would suspect trend to be most operative during periods of declining farm income and general prosperity in that land is the only residual claimant upon agricultural income that cannot move in response to higher returns outside the agricultural sector.

A serious question does exist as to whether the USDA's index of land values properly reflects current changes in the market value of land for agricultural purposes. According to the March *Farm Real Estate Market*:

"Several important regional factors are responsible for continued strength in the farm real estate market. Among these are urban and industrial expansion, demand for part-time farms and rural residences, increased demand for land for timber production, and climatic conditions with their resultant effects on crop yields and income expectations."[18]

It has been further suggested that the derived demand for land has shifted to the right as a result of farmers striving to take advantage of scale economies associated with full mechanization and an advanced agricultural technology.[19] The implication would be that historical relations existing in the land market are not entirely apropos with respect to predicting current behavior, or that variables which have been excluded from the model such as nonagricultural income are more operative today in determining land prices.

[18] U. S. Agricultural Research Service, *The Farm Real Estate Market* (Washington: United States Department of Agriculture, March 1956), p. 6.

[19] *Ibid*, July 1956, p. 5.

URBANIZATION AND THE INCOMES OF FARM AND NONFARM FAMILIES IN THE SOUTH[*]

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RECENT studies have amply documented the important relationships that exist between urbanization and the level of income achieved by both *farm* and *nonfarm* families in the United States as a whole and within the South.[1] The objective of this study is to explore

[*] This study was suggested by Vernon Ruttan, Department of Agricultural Economics, Purdue University. The research on which the study is based was carried out as a masters thesis under the direction of Lewis C. Copeland, David S. Chambers, J. Fred Holly, and Frank J. Williams, of the University of Tennessee.

[1] See for example Vernon W. Ruttan, "The Impact of Urban-Industrial Development on Agriculture in the Tennessee Valley and the Southeast," *Journal of Farm*

the differential impact of urbanization on the incomes of *farm* and *nonfarm* families *within* the major subregions of the South.

The subregions employed for this analysis are based on a new system of economic areas prepared by Bogue in 1954. The new system of economic areas is constructed by combining the familiar "state economic areas" and "economic subregions" into broader "economic regions" and "economic provinces" as outlined in Figure 1.[2] The analysis presented in this study compares the impact of urbanization on the incomes of farm and nonfarm families and unrelated individuals in the four "economic regions" within the "Southern Province." These economic regions are designated as:: Central and Eastern Upland (VII); Southeast Coastal Plain (VIII); Atlantic Flatwoods and Gulf Coast (IX); and South Center and Southwest Plains (X).

The analysis, using data from the *1950 Census of Population*, is based on a simple linear regression[3] between (1) the percent of the total population nonfarm in 1950, X, and the median income of *farm* families and unrelated individuals, Y_1, and (2) the percent of the total population nonfarm in 1950, X, and the median income of *nonfarm* families and unrelated individuals, Y_2, for a sample of counties in each of the four "economic regions." Following Ruttan, the percent of the total population that was *nonfarm* in each sample county was employed as a measure of the extent of urbanization. The sample consisted of 245 of the 1,342 counties in the Southern Province which embraces all or parts of 18 states. Eighty-four of the sample counties were from region VII; 81 from region VIII; 30 from region IX, and 50 from region X.[4] (cf. Figure 2.)

The statistical results of this analysis are presented in Table 1. Several rather important observations can be drawn from the analysis:

Economics, Vol. XXXVII (February 1955), pp. 38-56; John L. Fulmer, "Factors Influencing State Per Capita Income Differentials," *The Southern Economic Journal*, Vol. XVI (January 1950), pp. 259-278, and the literature cited in these two articles.

[2] Donald J. Bogue, "An Outline of the Complete System of Economic Areas," *The American Journal of Sociology*, LX:136-139, September 1954. According to Bogue, "In 1950 the entire land area of the United States was subdivided into homogeneous statistical areas which were called 'state economic areas.' This was accomplished by grouping similar counties. Later, a second, broader subdivision of the nation into economic subregions was developed. This second delimitation was derived by combining similar state economic areas. The present article introduces two additional and even broader delimitations which are termed 'economic regions' and 'economic provinces.' Together these four delimitations constitute a single integrated system of area classification." p. 136.

[3] The assumption of linearity was accepted after it was found that a simple parabola did not provide (at the 5 percent level) a significantly better description of the data for those regions whose dot diagrams showed the greatest tendency toward a curved-line relationship.

[4] A detailed discussion of the sampling procedure is presented in my masters thesis, "The Effects of Urbanization on Incomes of Farm and Nonfarm Families in the South," on file in the University of Tennessee Library.
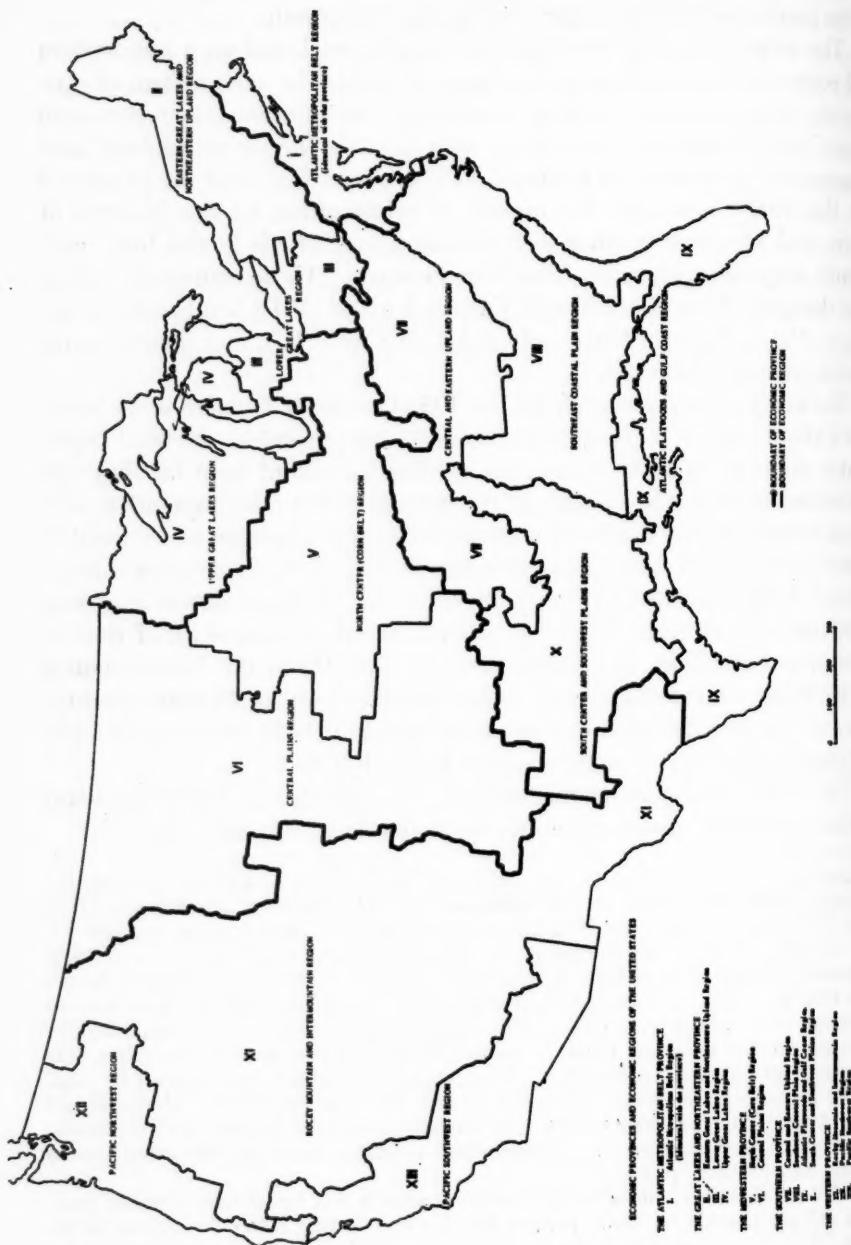
FIGURE 1. ECONOMIC PROVINCES AND ECONOMIC REGIONS OF THE UNITED STATES.
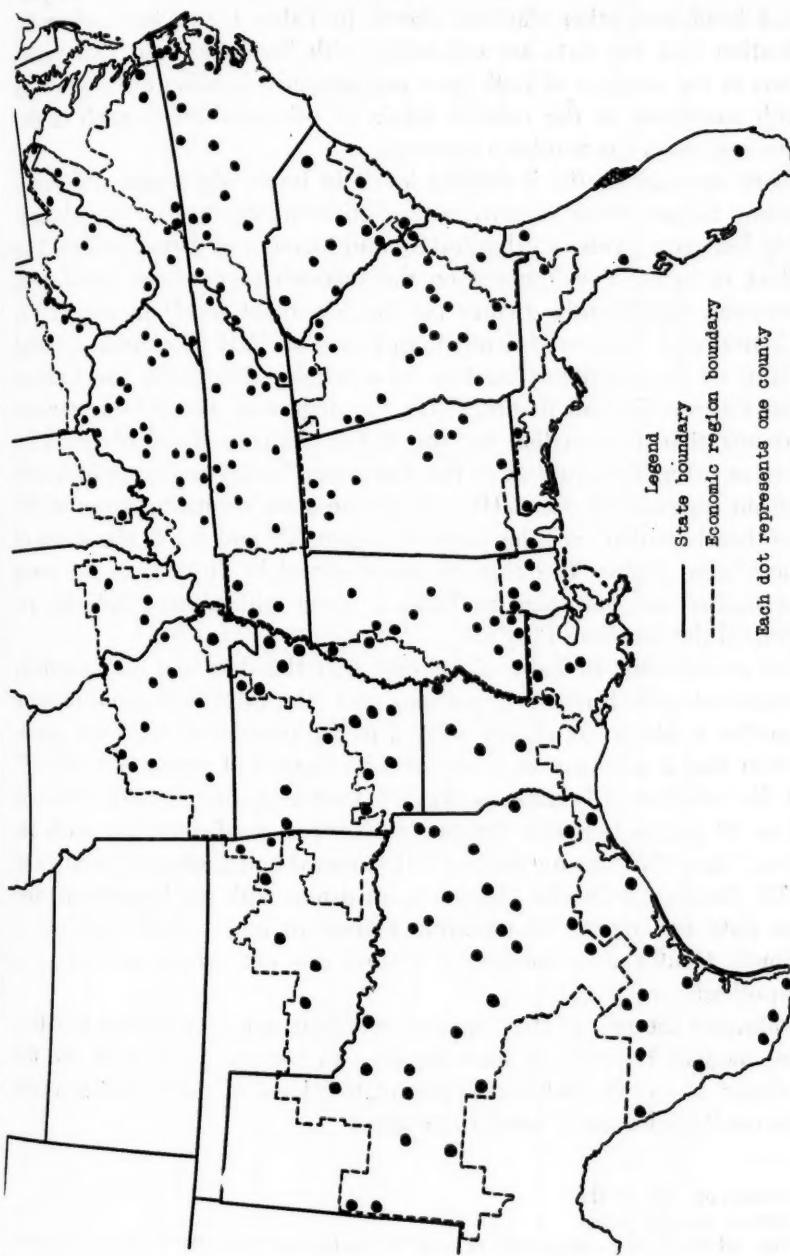
FIGURE 2. GEOGRAPHIC DISTRIBUTION OF SAMPLE COUNTIES AMONG REGIONS OF THE SOUTHERN PROVINCE.

FIGURE 1. ECONOMIC PROVINCES AND ECONOMIC REGIONS OF THE UNITED STATES.

1. The correlation coefficients, each of which is significant at the 5 per-
   cent level, and other statistics shown in Table 1, provide a clear in-
   dication that the data are consistent with the hypothesis that varia-
   tions in the incomes of both *farm* and *nonfarm* families are associated
   with variations in the relative levels of urbanization in each of the
   four regions of the Southern Province.
2. There appears (at the 5 percent level) to be no significant difference
   among the economic regions of the Southern Province in the relation-
   ship between levels of urbanization and incomes of *farm* families. The
   effect of urban development on the incomes of *nonfarm* families is,
   however, significantly greater (at the 5 percent level) in region VII
   (Central and Eastern Upland) than in region VIII (Southeast Coastal
   Plain) or the Southern Province as a whole. Except for the Central
   and Eastern Upland Region (VII), the degree of association between
   urbanization and median income is less than the level observed by
   Ruttan (a) in the counties of the Tennessee Valley region (which falls
   within regions VII and VIII); (b) in the state economic areas of the
   Southeast (which excludes most of region X); and (c) in the states of
   the United States. The correlations observed by Ruttan[5] in the areas
   he studied are presented in Table 2 along with similar data for re-
   gions of the Southern Province.
3. The correlations in Table 2 indicate that the data are only partially
   consistent with Ruttan's hypothesis that "the median income of *farm*
   families is almost as closely related to the percent of the total popu-
   lation that is nonfarm as is the median income of *nonfarm* families."[6]
   If the criterion of "almost as closely" is set as a difference of not more
   than 10 points between the two correlation coefficients for each re-
   gion,[7] then the data for regions VII (Central and Eastern Upland) and
   VIII (Southeast Coastal Plain) are consistent with the hypothesis; and
   the data for regions IX (Atlantic Flatwoods and Gulf Coast) and X
   (South Center and Southwest Plains) are not consistent with the
   hypothesis.
4. Following are two of the tentative conclusions regarding the fact that
   the median incomes of farm families in regions IX and X *are not*
   "almost as closely" related to the relative level of urbanization as are
   the median incomes of nonfarm families:

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[5] Ruttan, *op. cit.*, p. 41.

[6] Ruttan, *op. cit.*, p. 42.

[7] The arbitrarily-set differential of only 10 points is evidently a bit more severe
than the differential Ruttan permitted in drawing his conclusions; however, in the
instance in which he used the county as the basic unit—the 201 counties of the Ten-
nessee Valley Region—he observed, as shown above, a difference of only 7 points
between the two coefficients.

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TABLE 1. THE RELATIONSHIP BETWEEN THE MEDIAN INCOMES OF FARM AND OF NONFARM FAMILIES AND UNRELATED INDIVIDUALS IN 1949 AND THE PERCENT OF THE POPULATION NONFARM IN 1950. Summary Statistics Based on A Sample of Counties From Regions of the Southern Province

Region	The regression equation[a]	Arithmetic mean Ȳ	Ȳ / X̄	Standard deviation S_y / S_x	Standard error of the estimate $S_{y.x}$	Coefficient of: Correlation[b] r	Coefficient of: Determination r^2	F Ratio[c]	Standard error of: Correlation σ_r	Standard error of: Regression σ_b	Confidence limits[d] for: Correlation	Confidence limits[d] for: Regression $b \pm t_e \sigma_b$
(Part 1) *The relationship between the median incomes of farm families and unrelated individuals and the percent of the population nonfarm*												
VII	$Y_1 = 561.8366 + 15.7049X$	$1,231.89	52.55	$397.56 / 18.72	$307.36	.638	.407	38.00	.065	1.7916	.493–.749	10.12–17.29
VIII	$Y_1 = 478.9078 + 9.6175X$	974.36	51.51	357.51 / 17.02	321.80	.451	.203	21.36	.088	2.1014	.264–.617	5.41–13.82
IX	$Y_1 = 583.2835 + 11.0248X$	1,387.90	72.95	450.00 / 17.31	421.92	.387	.150	6.10	.155	4.4492	.070–.675	1.91–20.14
X	$Y_1 = 596.1609 + 17.9159X$	1,416.18	56.94	719.24 / 16.66	667.92	.395	.156	10.04	.119	5.6709	.139–.623	6.45–29.57
The Province	$Y_1 = 491.1553 + 13.1219X$	1,230.68	55.60	509.11 / 18.85	446.84	.480	.231	74.15	.049	1.5147	.371–.572	10.09–16.15
(Part 2) *The relationship between the median incomes of nonfarm families and unrelated individuals and the percent of the population nonfarm*												
VII	$Y_2 = 606.0187 + 19.4185X$	$1,628.42	52.55	$493.89 / 18.72	$358.34	.734	.539	98.18	.050	1.9721	.625–.824	15.47–23.36
VIII	$Y_2 = 823.0442 + 13.8081X$	1,535.15	51.51	456.21 / 17.02	395.89	.507	.257	28.70	.082	2.5852	.336–.664	8.64–18.98
IX	$Y_2 = 221.9031 + 20.4215X$	1,711.30	72.95	593.05 / 17.31	403.16	.578	.334	15.56	.122	5.2005	.300–.789	9.77–31.07
X	$Y_2 = 791.7098 + 16.1326X$	1,710.30	56.94	406.18 / 16.66	425.70	.530	.281	20.16	.102	3.6143	.309–.711	9.91–30.95
The Province	$Y_2 = 741.0862 + 15.8888X$	1,624.44	55.60	500.83 / 18.85	403.09	.597	.357	136.39	.041	1.3664	.508–.675	13.16–18.62

a Y_1. The median income of farm families and unrelated individuals, 1949.
  Y_2. The median income of nonfarm families and unrelated families, 1949.
  X. The percent of the total population nonfarm, 1950.
b Based on tests at the 5 percent level, the coefficients of correlation between the median incomes of *farm families and unrelated individuals* and the proportion of the population nonfarm are not significantly different among the four regions and Province; the coefficients relating to the median incomes of *nonfarm families and unrelated individuals* differ significantly only between regions VII and VIII and between region VII and the Province as a whole.
c The ratios indicate that the observed correlations are significant at the 5 percent level.
d The probability is .95 that the true value of the statistic for the region is included in the indicated range of values. Confidence intervals for the coefficients of correlation are based on the "z" transformation.

TABLE 2. CORRELATIONS BETWEEN PERCENT OF POPULATION
NONFARM IN 1950 AND MEDIAN INCOMES 1949

| | Correlation between the percent of population nonfarm in 1950 and: | | |
	(1) The median income in 1949 of farm families and unre-lated individuals	(2) The median income in 1949 of nonfarm families and unre-lated individuals	Differential
United States (48 States)[a]	.53	.659	.129
Southeast (104 state economic areas)	.55	.694	.144
Tennessee Valley Region (201 counties)	.68	.749	.069
Central and Eastern Upland Region VII	.638	.734	.096
Southeast Coastal Plain Region VIII	.451	.507	.056
Atlantic Flatwoods and Gulf Coast, Region IX	.387	.578	.191
South Center and Southwest Plains Region X	.395	.530	.135

[a] Income data for the states of the United States are for families only.

a. Communications facilities available to the farm populations of re-
gions IX (Atlantic Flatwoods and Gulf Coast) and X (South Center
and Southwest Plains) are traditionally better than those in regions
VII (Central and Eastern Upland) and VIII (Southeast Coastal
Plain).
b. Part-time farming activity, in response to urbanization, has been
more spontaneous and is greater in relative magnitude in regions
VII and VIII than in regions IX and X.

Also, although percent of the population nonfarm may be an adequate
measure of urbanization when related to farm family income, it leaves
something to be desired in measuring the effects of urban growth on
the incomes of nonfarm families. The difference observed in the rela-
tionship between urbanization and nonfarm family income in regions
VII (Central and Eastern Upland), and VIII (Southeast Coastal Plain),
may be due to the fact that this measure (percent of the population
nonfarm) does not take into account regional differences in the indus-
trial complex of developing urban centers.

DIVIDING SOIL BANK PAYMENTS BETWEEN LANDLORD AND TENANT

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HOW should payments under the Soil Bank Act be divided between landlord and tenant under a crop-share lease? This is one of the questions most frequently asked in regard to the program. The Soil Bank Act provides no definite answer, merely stating the following:

"In the formulation and administration of programs under this title, the Secretary shall provide adequate safeguards to protect the interests of tenants and sharecroppers, including provision for sharing, on a fair and equitable basis, in payments or compensation under this title, and including such provision as may be necessary to prevent them from being forced off the farm. Applications to participate in any such program shall specify the basis on which the landlord, tenants, and sharecroppers are to share in such payments or compensation, and no contract under any such program shall be entered into unless such basis is approved by the county committee and incorporated into the contract. The standards prescribed by the Secretary for the guidance of county committees in determining whether any such basis shall be approved shall include the requirement that consideration be given to the respective contributions which would have been made by the landlord, tenants, and sharecroppers in the production of the crops which would have been produced on the acreage diverted from production under the contract and the basis on which they would have shared in such crops or the proceeds thereof."[1]

A procedure sometimes suggested is to divide the payment according to the shares normally used for crops, as ⅓ and ⅔, 50-50, etc. This, however, may not be really equitable, since when land is placed in reserve, one party's expenses may be reduced considerably more in proportion to his customary share than are the other's.

What alternative basis should then be used for the division of the payment? First of all, we need to consider what is involved in a leasing arrangement. Basically, if a lease is equitable, the distribution of crop shares to the landlord and tenant is in proportion to the value of their contributions. If the tenant's contributions (labor, management, machinery, fuel, seed, and other items) are valued at twice those of the landlord (the use of his land and perhaps such other items as grass seed and fertilizer), the tenant's share is ⅔ and the landlord's ⅓. If the contributions are of equal value, then output is shared 50-50. As a result, net income is shared in the same proportions.

When land is placed in the Soil Bank the reserve payment is generally less than the value of an average crop. The tenant's expenses are usually considerably reduced, and the landlord's are affected only slightly, if at

[1] Agricultural Act of 1956, Title I, Sec. 122.

all. We might propose that the payment be shared in proportion to the new contributions. However, the landlord's contributions are unchanged, or at most reduced only slightly, and the tenant's are apparently practically nil! If the payment is divided on this basis the result is precisely what the Soil Bank Act goes to great lengths to forbid—the landlord receiving greater returns than usual, and the tenant being practically dispossessed of the banked land. Apparently, then, this procedure is no more satisfactory than the usual share division. Some middle ground must be found.

In the opinion of this writer, when net income is reduced as a result of land being placed in the acreage or conservation reserve, the fairest and most equitable arrangement is one that provides for the reduction of the net returns to each party by the same percentage. If total net income is reduced by 10 percent, then the landlord's and tenant's net shares should each be reduced by 10 percent. Net income would still be shared in the usual proportions, and the following relationship exists:

$$\frac{\text{Landlord's net returns from Soil Bank Acres}}{\text{Tenant's net returns from Soil Bank Acres}} = \frac{\text{Landlord's usual share of crops}}{\text{Tenant's usual share of crops}}$$

This proportion can be used in deriving a formula for the equitable division of the payment:

Let L = landlord's usual share of contributions and crop (expressed as a fraction or decimal)

T = tenant's usual share

C = total contributions by both parties for the crop being replaced by Soil Bank reserve

R_L = reduction in landlord's expenses on land placed in the Soil Bank

R_T = reduction in tenant's expenses

P = total Soil Bank payment

X = the amount of the landlord's equitable share of the payment.

Then $P - X$ = the amount of the tenant's share, and

$$\frac{X - (LC - R_L)}{(P - X) - (TC - R_T)} = \frac{L}{T}$$

Then, $TX - TLC + TR_L = LP - LX - LTC + LR_T$

$X(T+L) = LP + LR_T - TR_L$

Since $T + L = 1$, and $T = 1 - L$,

$X = LP + LR_T - TR_L = LP + LR_T - (1-L)R_L$

$= LP + LR_T + LR_L - R_L = L(P + R_T + R_L) - R_L$

Similarly, the tenant's share equals

$$T(P + R_T + R_L) - R_T.$$

These, when added together, equal P, the total payment.

In using this formula for the division of the payment under the Soil Bank Act, we in effect consider the contributions made by each party to be unchanged and proceed to include the savings made by each as a part of the income to be distributed. We add the total savings of both parties to the amount of the payment, divide this total according to the customary shares, and subtract each party's savings from his share, to arrive at the net amount of his payment. Each party's share of the total is then made up of his soil bank payment, plus his savings from placing land in reserve, and his contributions are considered to be the same as usual. This is in accord with the Soil Bank Act, since consideration is given to the "contributions which would have been made" and the shares which would have been received by each party, had the land been cropped.

No positive evaluation of total active contributions on reserve land is attempted or required. This procedure is based on the assumption that the basic lease is equitable, and provides for adjustment only for marginal changes in costs. It allows returns to continue to accrue to labor, management, machinery, and to the land that would normally be used in production. Finally, after the costs of these items have been covered, net profits are distributed according to usual shares, *not* the shares of contributions actually made under the artificial conditions of the Soil Bank Act.

The problem remaining is that of determining just what saving or reduction in expenses occurs when land is placed in the acreage or conservation reserve. Items affected are variable costs such as fuel, oil, grease, repairs, seed, twine, fertilizer, and custom work. Some items, such as fertilizer and custom work, are easy to figure; the costs of machine operation may be more difficult. Records can be kept on the amount of fuel, oil, and grease used on other fields of the crop being replaced by reserve acreage. Or experimental records can be consulted. Past and current records of the farm can be used to determine the general relationship between fuel and repair costs, and this ratio can be used in estimating the savings in repairs. On many farms repair and fuel costs tend to be approximately equal, so this relationship may be used if desired.

Labor costs should be considered if less labor is hired. The tenant's labor and management and the labor of his family, however, can only be considered in case he begins to operate more land or he or another member of the family takes on other work as a result of placing this land in reserve. Otherwise they are like the landlord's land—they represent fixed costs. Depreciation, too, is largely fixed, since much of it arises from weathering and obsolescence. Whatever reduction in depreciation may

occur can logically be thought of as balancing the reduction in the depletion of the soil of the landlord's land.

In summary, if net income from the reserve acres is to be distributed according to usual shares, the following procedure should be followed:

1. Compute the total soil bank payment for the field in question.
2. Compute the amount by which the landlord's expenses are reduced.
3. Compute the amount by which the tenant's expenses are reduced.
4. Add these three amounts.
5. Divide the total according to usual crop shares.
6. Subtract the amount of each party's reduction in expenses from his share—the result is his equitable share of the soil bank payment.

Example:

On a farm rented on a ⅓-⅔ basis, 20 acres are to be placed in acreage reserve. If the landlord's expenses are reduced by $1.10 per acre and the tenant's expenses by $5.20 per acre, and if the total soil bank payment is $33.12 per acre, the amount to be divided is as follows:

Soil bank payment—20 X $33.12 . . . . $662.40
Landlord's savings—20 X   1.10 . . . .   22.00
Tenant's savings—20 X   5.20 . . . .   104.00
_____
Total $788.40
Landlord's ⅓ share $262.80
Less landlord's savings .   22.00
_____
Landlord's share of payment $240.80
Tenant's ⅔'s share 525.60
Less tenant's savings . . 104.00
_____
Tenant's share of payment $421.60
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Total of soil bank payments $662.40

This procedure is applicable to both the acreage reserve and conservation reserve payments, but not to ACP payments for establishing cover. The latter must be made according to ACP regulations, and should be taken into consideration in computing the adjustments in costs on land placed in the soil bank.

NOTE ON J. N. BOLES' "SHORT CUTS IN PROGRAMMING"*

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J. N. BOLES in a recent paper[1] has described a method of eliminating superfluous rows and columns from a programming matrix. The method, which is essentially due to Waugh and Burrows,[2] has only been described for the special case where all resource supplies and all net revenues are positive. In this case resource and activity units are redefined (or standardized) to give a resource supply of 100 for all resources and a net revenue of $100 for all activities. If for two resource rows A and B, row A has no elements larger than the corresponding elements in B, then A will never limit production before B, and row A can be left out of the programming computations without affecting the answer. Similarly for two standardized activities A and B, if A has no elements smaller than the corresponding elements in B, then there is no resource that A uses more efficiently than B, and A can be left out of the problem without affecting the answer.

The above argument is, of course, presented in greater detail in Boles' article. The present note points out that the same technique can be used even when there are zero resource supplies and zero or negative prices. Activities with negative prices can, of course, be standardized so that every such activity has a negative net revenue of −$100. Rows with zero resource supply can be standardized on some other column, so that all entries in this other column are equal. Similarly activities with zero revenue can be standardized on a row other than the net revenue row, so that all entries in at least one row are equal. When standardization has been carried out in this fashion the same arguments used to eliminate unnecessary rows and columns in Boles' article can be used to eliminate further rows and columns. Again, for any two activities A and B *with the same net revenues,* where A has no elements smaller than the corresponding elements in B, A can be dropped from the problem without affecting the optimum plan. For any two resources A and B, *with the same resource supplies,* where A has no element larger than the corresponding element in B, A can be dropped from the problem without affecting the optimum plan.

[1] J. N. Boles, "Short Cuts in Programming Computations," *Journal of Farm Economics,* Vol. 38, p. 981 (1956).
[2] F. W. Waugh and G. L. Burrows "A Short Cut to Linear Programming," *Econometrica* Vol. 23, (1955).

INFLUENCE OF RAINFALL ON FERTILIZER PROFITS[*]

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THERE has been considerable recent interest in the economic analysis of fertilizer response.[1] These efforts usually estimate yield as a function of one or more elements of fertilizer. However, farmers know and economic theory indicates that the response to fertilizer depends upon the level of other inputs in the crop production function. One major factor affecting the response is the level of moisture.

This note presents a method of including rainfall as a variable in choosing between no fertilizer and one rate of application. It also illustrates the use that can be made of agronomic experiments carried out in the past. The relationship between rainfall and yield response of a fertilized over nonfertilized treatment is presented. On the basis of this relationship and historical rainfall data the "odds" of profitable use of the rate at several locations is presented.

A total of 15 fertilizer experiments on forage production were carried out at 5 different locations in East Texas during the period 1948-53. These experiments were conducted on upland native pastures with similar vegetative composition. The soil series, Lufkin and Bowie, are very similar in their response to fertilizer and comprise a major portion of the upland soils of the East Texas Area.

A fertilizer treatment equal to an annual rate of 60 pounds of nitrogen, 30 pounds of phosphoric acid and 30 pounds of potash was common to all experiments.[2] This also is a rate of application commonly used in the area.

Correlations between yields and rainfall were computed for the fertilized and unfertilized treatments with three rainfall periods: January through September, February through September, and March through September. Slightly higher coefficients were obtained using the March

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[1] See Paul R. Johnson, "Alternative Functions for Analyzing A Fertilizer-Yield Relationship," *Journal of Farm Economics*, Vol. 35, No. 4, November 1953, pp. 519-530; Earl O. Heady and John Pesek, "A Fertilizer Production Surface," *Journal of Farm Economics*, Vol. 36, No. 3, August 1954, pp. 466-482; and Burton L. French, "Functional Relationships for Irrigated Corn Response to Nitrogen," *Journal of Farm Economics*, Vol. 38, No. 3, August 1956, pp. 736-748.

[2] In certain experiments P_2O_5 and K_2O were not applied each year, however, since agronomic analysis and opinion indicate the rate used would give approximately the same response as the rates used in the experiments.

through September period. The coefficient between fertilized yield and March-through-September rainfall was 0.71, and for nonfertilized yield and rainfall the coefficient was 0.63.

One possible method of developing the relationships between rainfall and yield is to fit two functions, one for the fertilized and one for the nonfertilized treatments. The response of fertilizer would be obtained by the difference between the results of substituting a given level of rainfall in these two functions. Since there are errors of estimation for both equations, however, nothing is known about the errors of the difference.

Thus, both rainfall and fertilizer were included in one equation. Fertilizer was entered as a discrete variable, 0 if nonfertilized and 1 if fertilized. Preliminary graphing indicated yield to be a linear function of rainfall, thus the squared term was not put in the equation. The results are presented in equation (1). The coefficient of determination (R^2) was 0.821.

(1) $Y = 111.15\ X_1 - 763.36\ X_2 + 106.89\ X_1 X_2 - 1278.74$ [3]

Where Y = yield of forage per acre in pounds

X_1 = March–September rainfall in inches

X_2 = fertilizer treatment: if non-fertilized, 0; if fertilized, 1

When fertilizer is used, $X_2 = 1$ and equation (1) becomes

(2) $Y = 218.04\ X_1 - 2042.10$

When fertilizer is not used, $X_2 = 0$ and equation (1) becomes

(3) $Y = 111.15\ X_1 - 1278.74$

Profit from the use of the 60-30-30 rate can be expressed as a function of rainfall as in equation (4). Equation (4) is obtained by subtracting equation (3) from (2) and considering the value of forage and the cost of fertilizer.[4]

(4) $P = (106.89\ X_1 - 763.36) V_F - C_F$

Where P = profit

X_1 = March–September rainfall in inches

V_F = value of forage per pound

C_F = cost of 60-30-30 including application

The stream of profits over the years can be obtained from the use of this rate by substituting historical rainfall data into equation (4). This procedure will probably overstate actual historical losses in the low rainfall years and profits in high rainfall years, due to increases and decreases in the local price of forage.

The minimum amounts of rainfall necessary to break even can be

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[3] The standard errors of the coefficients are: X_1, 13.8, significant at the 1 percent level; X_2, 1,116.4, significant at the 50 percent level; and $X_1 X_2$, 39.3, significant at the 5 percent level.

[4] Approximately the same equations were obtained when yield was fitted as a function of rainfall to the data from the fertilized plots and the check plots.

obtained by setting profit equal to zero and solving for X_1. For example, with forage valued at \$20 per ton and the cost of fertilizer assumed at \$13.70,[5] 19.9 inches of March-through-September rainfall would be required to break even. By counting the number of years with rainfall above this minimum yield, and also below, the "odds" or simple probability of the rate being profitable in a given year can be obtained.

Since the soil series are common to much of East Texas the above relationships and historical rainfall data were used to present the simple probabilities for 25 locations in East Texas, Table 1. This information should be of some use to farmers in making fertilizer decisions.

TABLE 1. PER CENT OF YEARS AN ANNUAL FERTILIZER RATE
OF 60-30-30 WILL BE PROFITABLE[a]

Location	Length of rainfall records	Value of forage		
		\$15 per ton	\$20 per ton	\$25 per ton
	(years)	(Per cent years)	(Per cent years)	(Per cent years)
Anderson	39	49	74	83
Beaumont	61	74	85	94
Bon Wier	37	83	97	97
Bronson	30	60	83	90
Clarksville	46	58	83	96
College Station	63	35	60	82
Conroe	29	56	66	86
Crockett	26	51	73	88
Dialville	49	59	82	94
Gilmer	22	50	77	87
Henderson	46	50	67	85
Huntsville	65	51	79	89
Jefferson	42	57	79	90
Liberty	51	69	90	96
Longview	61	54	72	87
Lufkin	40	58	88	95
Marshall	45	58	69	80
Mount Pleasant	31	58	71	87
Nacogdoches	54	58	82	93
Naples	23	52	83	87
Palestine	69	35	74	82
Rockland	50	66	82	88
Sulphur Springs	29	52	69	87
Trinidad	39	28	62	80
Tyler	21	62	76	95

[a] Cost of fertilizer including application assumed to be \$13.70.

[5] Nitrogen was valued at 13 cents per pound, phosphorous at 8 cents per pound and potassium at 5 cents per pound. An allowance of \$2 was included for application costs.

IDENTIFYING MANAGEMENT ALTERNATIVES*

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EXTENSION workers engaged in activities relating to farm and home development are seeking improved techniques for teaching farm families to solve management problems effectively. After much debate and many sets of instructions, our methods still are probably far from ideal. The purpose of this note is to direct more critical attention to a step seemingly neglected in solving management problems—the careful identification of alternatives.

Management problems are solved through analysis and action. Rational decision making is an integral part of this process. The essence of decision making is choosing among alternatives. Obviously alternatives must be identified before a choice can be made. But farm management workers and others seem to have given much more attention to the problem of evaluating alternatives than of identifying them.

In a farm management context, an alternative represents some future course of action in operating the farm business. Seldom if ever, can all the implications or consequences of given acts be outlined in advance. Yet a single change often requires corresponding adjustments in several closely related aspects of the farm business. Unless the full complex of changes is identified for the time period under consideration, rational choice among alternatives would seem to be difficult.

Alternatives are passive or active in nature, depending on the amount of action they require. The passive alternative for most situations is to continue without change. Active alternatives require adjustments in one or more of the interrelated segments of the farm business.

A recent study provided an opportunity to obtain information on the identification of active alternatives during consultations between county extension agents and their cooperating farmers. Eight agents were asked to discuss some of the more important management problems with which they had been concerned. They were also asked to name several farmers who had consulted with them on any one of the designated problems. Four farmers in each of the eight counties were then selected to represent a variety of problem situations.

Interviews with the agents and later with the farmers were directed toward learning as much as possible about the techniques used in the preceding consultations. Special attention was directed toward learning the number of alternatives identified in analyzing each problem, and the clarity with which each alternative had been identified for decision

making. The study results depend on a subjective appraisal, but they seem to be at least highly suggestive in several respects.

The interviews revealed a considerable range between specifically identified and vaguely identified alternatives, and also between those that were completely identified and those that were incompletely identified. An alternative is specifically stated when certain actions are precisely and explicitly formulated, in contrast to a vague alternative considered in general rather than definite terms. To expand the dairy herd is a vague alternative; to add 10 more cows is a specific alternative. The distinction is between qualitative statements and quantitative statements of expected changes.

Completely identified alternatives explicitly specify an entire combination of interrelated changes. This requires an understanding of how the various segments of the farm business will be affected if an initial change is made. To increase a dairy herd by ten more cows would undoubtedly require adjustments in labor, feed, barn space, and milk handling capacity. It might also mean delaying improvements in the farm home. A completely identified alternative would specify such interrelated changes.

The results of changes may be immediately observed, or there may be a period between the time when the changes are made and the results observed. A changed feed ration for dairy cattle may immediately increase their milk production, whereas the effects of a changed tillage practice may not be observed until the crops are harvested the following year. A completely identified alternative would also specify when and for how long the changes would be effective.

The results of the interviews were grouped according to the clearness with which active alternatives were identified by both the agent and the farmers. The three categories used in this grouping were clearly identified, fairly well identified, and only roughly identified. An active alternative was classified as being clearly identified if it was specifically and completely identified—specifically enough for budgeting and completely enough to show the principal changes in interrelated segments of the farm business. An active alternative was classified as being fairly well identified if it was moderately specific and complete enough to show changes in some of the interrelated segments of the farm business. Alternatives that were briefly mentioned but not discussed in either specific or complete terms were classified as being only roughly identified.

Among the thirty-two farmers interviewed, twenty-five recalled and discussed the same management problems reviewed by their county agents. The other seven farmers discussed problems that seemed to be different from those reviewed by their county agents. Therefore, the joint consideration of alternatives by agents and farmers could be studied in only twenty-five cases.

One or more alternatives were clearly identified in only thirteen of these twenty-five cases. That as many as two active alternatives were clearly identified in only three of these thirteen cases is especially noteworthy. Only one alternative was identified in the remaining ten cases. Obviously, alternatives clearly identified in discussion between farmers and agents are relatively few in number.

In the thirteen cases where active alternatives were clearly identified, the agents were well acquainted with the farming business. The agents knew the acres of land each farmer was managing, the livestock enterprises, and the number of animals of each kind. The agents also reported fairly accurately the yields and acres of important crops. Crops and crop yields are usually not static; therefore, minor differences would be expected in comparing the agent's figures with the farmer's.

Little knowledge of the farm business by agents was characteristic of the cases in which active alternatives were not identified clearly.

The degree to which alternatives were clearly identified also seemed to be related to the stage of decision making. The decision-making process is not ordinarily instantaneous, and the following stages can often be recognized:

1. *Discontent.* A manager in the stage of discontent recognizes that a problem exists but has no solution in mind.
2. *Consideration of alternatives.* This is the stage of analysis. The analysis can be with special interest, specific restrictions, or relatively complete elaboration.
3. *Initial selection and verification.* In this stage, a manager makes a tentative decision and seeks verification from other sources.
4. *Tentative action and review.* In this stage, the manager commits resources, usually on a small scale, to test results.
5. *Full commitment.* This is the stage in which a manager makes a final decision and fully commits available resources to the chosen course of action.

These stages are closely related to the stages that Beal and Bohlen[1] have noted for the acceptance of new ideas. Here, however, we are concerned with the general process of formulating management decisions—not necessarily with the introduction and acceptance of new ideas from external sources.

In all thirteen cases where the recollections of agents and farmers revealed one or two clearly identified active alternatives, the farmers had apparently approached their agents while in early stages of decision

[1] *How Farm People Accept New Ideas,* Special Report No. 15, Agricultural Extension Service, Iowa State College, November, 1955.

making. In these cases, the interviewer found action in progress or completed with expressed satisfaction.

Conversely, when farmers approached agents after developing special interests or tentative decisions, further identification of alternatives seems to have received little attention. Instead, attention often focused on some one change—remodeling the dairy barn, for example—without much consideration of related adjustments in crops, livestock, or other features of the farm business. Following this sort of counseling, however, several farmers were left with doubts about the advisability of going ahead with the changes discussed, and others expressed dissatisfaction with the results of changes made. Hence, the interviews suggest that failure to identify alternatives clearly may lead to inaction or dissatisfaction with the action taken.

The process of identifying and evaluating important alternatives almost necessarily implies a preliminary selection in which many less promising possibilities are discarded with scant consideration. Perhaps the farmers and their agents did such an effective job in making the preliminary selection that further consideration of alternatives would have served no useful purpose. But to say the least, this seems highly improbable. Instead, the interviews point to the probable inadequacy of present efforts in helping farmers to identify and evaluate alternatives. Most farmers, of course, probably receive even less assistance than the ones interviewed.

These results have important implications for extension workers engaged in farm and home development activities. When farmers are in the early stages of decision making, they are ready for agents to assist them in identifying the more promising management alternatives. Often, however, they advance to the later stages of decision making without fully considering important possibilities. Techniques of management teaching that stimulate farm people to identify possible alternatives are urgently needed in extension. Without this stimulation, management ability is unlikely to develop very far.

SOME QUESTIONS ON THE BERINGER PAPER

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ESTIMATING production functions is interesting and perhaps a useful research in production economics. Sometimes, however, those who are not actively engaged in the details of such work have difficulty in clearly understanding the procedures. With this difficulty in mind

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certain questions related to a particular bit of research reported in this
Journal by Christoph Beringer[1] seem in order. In his article the author
concludes that enterprise production functions on multiple enterprise
farms are independent. This conclusion appears to conflict (and other
conflicts exist) with parts of his discussion. Particularly perplexing were
the following:

(1) In discussing past studies of production functions on multiple en-
terprise farms the article states, "The estimation of the individual func-
tions was not done on the basis of detailed enterprise cost accounts but
rather on the basis of arbitrary allocation of the total quantity of inputs
and investments used on the farm to individual enterprises." We assume
that there is a difference between arbitrary allocation and detailed cost
accounting. Therefore we ask the following:

(a) How would tractor use for manure hauling be allocated between
    crops and livestock?
(b) How would the costs of maintaining a machine be allocated among
    various enterprises?
(c) How are the maintenance costs of line fences distributed?

(2) Beringer states that "Changes in the relative quantities of produc-
tion factors employed are *not* structural changes since they reflect a shift
of production along the production surface but not a change in the pro-
duction surface as such." What structural changes can take place without
changing the relative quantities of production factors employed, i.e.,
does not the elimination, replacement, or addition of production factors
change the relative quantities of production factors employed?

(3) Also "Various forms of complementarity that might exist within
one enterprise, or among enterprises, are not likely to change the nature
of the physical production functions for individual enterprises. . . . This
statement holds only as long as the inputs are not priced in terms of their
on-farm opportunity costs. Otherwise the production functions would
change every time the relative prices of inputs changed." Is it obvious
that changes in input prices should affect the physical production func-
tion?

(4)"Internal economies and diseconomies that exist on farms where
more than one major enterprise is present are not factors that change
the physical production function even though the scale line on the pro-
duction surface might differ considerably from the one applicable on
specializing farms." If this is true, and if the general conclusion that
". . . enterprise production functions on multiple enterprise farms are

[1] Christoph Beringer, "Estimating Enterprise Production Functions From Input-
Output Data on Multiple Enterprise Farms," *Journal of Farm Economics*, Vol. 38,
November, 1956.

independent of each other but are usually not the same as the corresponding functions on specializing farms" is also valid, to what is the difference attributed?

(5) ". . . it is not considered necessary to use the simultaneous equations approach for estimating production functions if the investigator is able to obtain enterprise input-output data that indicate with sufficient accuracy the input used and the outputs produced by the individual enterprises." Is "sufficient accuracy" obtained by detailed cost accounting or arbitrary allocation?

(6) "Vertically integrated enterprises such as crops and livestock enterprises should be treated separately, otherwise it is not possible to determine accurately where in the farm business a reallocation of inputs is necessary." Since the separation was made so that land contributed only to the crop and not to the livestock enterprises, and the functions are *independent*, does this imply that no land is required for the livestock enterprises?

(7) If enterprise production functions are actually independent of each other, it should be possible for the level of output for all but one product to decrease sharply, *without a change in the production function of any of the products*. Carrying this one step farther, the output of all enterprises save this one could go to zero and this one be carried on at a very high level of output. Thus, the multiple enterprise farm has become a specialized farm *without a change of production functions*, or if preferred, a multiple enterprise farm with only one enterprise being carried on at a level greater than zero. Hence, can one logically state that enterprise production functions on multiple enterprise farms are independent of one another and yet different from those existing on specializing farms?

(8) Were the enterprise production functions on these multiple enterprise farms really independent?

REPLY TO QUESTIONS BY PROFESSORS PUTERBAUGH AND LAMPE

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MOST of the questions asked by Professors Puterbaugh and Lampe concerning my article in the November 1956 issue of this *Journal*[1] are very relevant and I should like to reply to them in the order in which they were put to me by my critics.

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[1] Christoph Beringer, "Estimating Enterprise Production Functions from Input-Output Data on Multiple Enterprise Farms," *Journal of Farm Economics*, Vol. 38, November 1956.

1) "Arbitrary allocation of input factors in past studies" refers to an allocation made mostly on the basis of outputs produced or a similar criterion *in lieu* of detailed cost accounts. For example if ⅓ of the livestock output on a farm was produced by a hog enterprise and the remainder by the beef enterprise, allocation of the total quantity of feed consumed by the individual enterprises was made on the basis of ⅓ to hogs and ⅔ to beef. Detailed cost accounts would have recorded the actual quantities consumed by individual enterprises. It is true however that even the most detailed cost accounts will still contain a series of arbitrary allocations. My critics mention two good examples—the allocation of manure hauling to individual enterprises and the allocation of costs of maintaining line fences. Machinery maintenance which they also use as an example can be allocated according to the number of hours the machine has been used in each individual enterprise.

It is obvious that the accuracy of any cost accounts is a matter of degree and a function of the amount of money and effort one is willing to extend in obtaining accurate information.

2) Structural changes as I defined them involve addition, complete replacement, or deletion of production factors from the production process. The replacement of horses by tractors or the addition of stilbestrol and similar hormones in livestock feeding are examples. Changes in the relative quantities of production factors used, e.g., substitution of grain for hay as a result of relative price changes, can not be regarded as structural changes (i.e., changes in the nature of the production function.)

3) It is not at all obvious that input price changes should affect the physical production function. This is especially true in the short run and when relative prices vary widely from year to year. If a shift in relative prices is a lasting one it is possible (may not be obvious!) that technological developments will be speeded up involving mainly that production factor whose marginal value productivity has risen. The result could then be a change in the nature of the physical production function.

4) The difference is attributed mainly to the presence of by-products occurring on multiple enterprise farms which are substitutable for commercial inputs. The physical production functions will be independent if by-products are properly credited to the producing enterprise and charged as an input to the utilizing enterprise.

5) See answers to question (1).

6) Use of feed (commercial and home-grown feed including pasture converted on a hay-equivalent basis and priced at the prevailing market rates) as a separate input category prohibited the use of land as an input category in the livestock enterprises; including it would have introduced double accounting. This does not mean that no land was used by the livestock enterprises. However I preferred to include land in terms of

feed it produced. This enabled me to estimate the marginal value productivity of feed when marketed through livestock.

7) It was indicated previously that shifts along the production surface of one enterprise caused by any changes in surrounding enterprises should not be regarded as "changes in the physical nature of the production function," since they merely reflect adjustments to changes in relative prices of production factors. If, as my critics have assumed, the level at which these surrounding enterprises were carried on, should go to zero, the production function of the remaining enterprise would necessarily change to where it is the same as on specializing farms, provided of course that the production function was at all different in the first place. By assuming that the function was different, it appears to me that there is a range over which enterprises vary without affecting the nature of the physical production function of the remaining enterprises. Over that range one can make the assumption of independence among production functions. Also it appears that one of the very reasons for the existence of several enterprises on a farm is the knowledge on the part of the operator that physical production functions available to him are different and presumably more advantageous than the corresponding functions on specializing farms. If this is the case he will certainly try to operate his enterprises over a range that will permit him to preserve this advantage.

8) For the reasons given in the answer to question (7) the production functions on the farms included in my sample were believed to be independent over the range covered by the data.

A SHORT-RUN SUPPLY RELATIONSHIP FOR EGGS IN MINNESOTA[*]

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SINCE World War II a debate has been waged at many different levels, in many different contexts by many different proponents with regard to the relative merits of single-equation regression techniques and simultaneous-equation techniques for estimating parameter coefficients of the economic system. And recently George Judge has helped clarify the issues in the debate by pointing out that the real problems are not at the estimating level, but rather at the stage of economic-model formu-

lation.[1] Once the economic model has been specified the estimation procedures flow automatically from the model. Further, and also rather recently, Herman Wold, has argued that an important kind of system in the economic world is a recursive system—namely, where causation flows unilaterally through dated time from variable to variable.[2]

Now it is not the purpose of the brief analysis which follows to resolve the larger problem—the problem of the proper place of simultaneous and recursive systems in the economic world. But the authors do feel that much of the agricultural economy fits the recursive concept (i.e., is recursive in nature). This is particularly true, it would seem, on the supply side at the farm level. The following analysis is thus presented *to illustrate* the estimation of coefficients of supply elasticity where the sector of the economy involved is deemed to be recursive in nature. Further, with the current interest in supply relationships, the estimate of the supply elasticity for eggs obtained should be of interest.

The Economics of the Situation

Throughout this analysis it will be assumed that the number of egg producers in Minnesota is so large that no one of them can affect price significantly, and that there is freedom of entry in the industry. Whenever this analysis is concerned with a single firm, it is concerned with a "representative" firm.

A short-run supply curve, specifying a time of such duration that producers have fixed costs, is the horizontal summation of the marginal cost (MC) curves of all the producers of the good in question. Its shape is dependent on two considerations: (1) the shapes of the individual MC curves, and (2) the variation in the minimum points of average total cost and of average variable cost from firm to firm. Before the MC curve of an egg-producing firm, hence the short-run supply relation of the industry, may be hypothesized, however, it becomes necessary to delineate the variable and fixed costs.

If farmers decide to produce eggs, they must incur fixed costs. The costs of raising pullets and/or buying old hens, and building and equipment costs, may all be considered fixed costs. Since family labor is usually used for tending the flocks and since hired labor costs do not vary with the rate of production, unless, of course, production is stopped, labor costs can also be considered as fixed.

A contention of this paper is that the only variable cost of any consequence in the short run is the cost of feed; egg producers will continue production as long as egg prices cover feed costs. This contention is

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[1] Discussion: A Comparison of Single and Simultaneous Equation Techniques, *Journal of Farm Economics,* Proceedings Number, Vol. XXXVII, Dec., 1955, pp. 992-995.

[2] *Demand Analysis,* John Wiley and Sons, New York, 1953.

consistent with the views of Morrison and Judge. They argue that: "Egg producers tend to continue production once the birds are housed so long as the returns cover feed costs or until the end of the production period."[3]

From various studies, it appears that the functional relationship between egg output and feed input is linear up to the eating capacity of the flock.[4] Such a production function is shown in Figure 1.
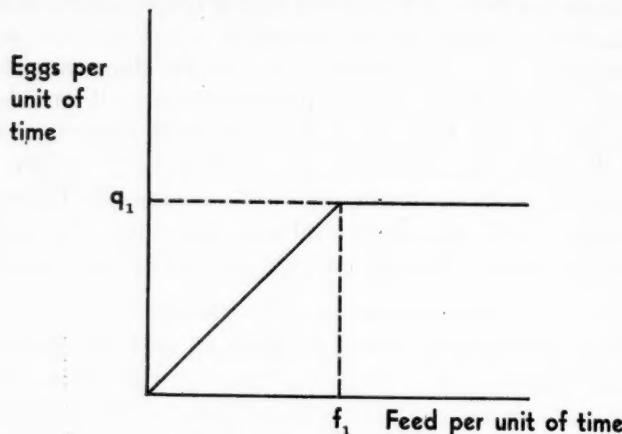

FIGURE 1

If the production function is as indicated in Figure 1, and if constant feed costs are assumed, then the firm's MC curve is given below in Figure 2.
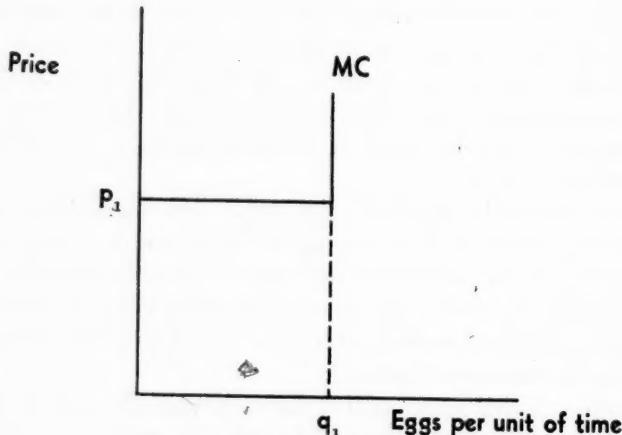
FIGURE 2

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[3] T. C. Morrison and G. G. Judge, "Impact of Price Expectations and Uncertainties on Decision Making by Poultry Firms," *Journal of Farm Economics*, Vol. XXXVII, November 1955, p. 660.

[4] P. L. Hansen, "Input-Output Relationships in Egg Production," *Ibid.* Vol. XXXI, November 1949, pp. 687-697.

The important point to be made here is that over a wide range of egg prices, egg production will remain constant—at q_1 in Figure 2. If it is profitable to produce eggs at all, then the most profitable rate of production is a maximum rate of production. Thus, if only the slope of the MC curve is considered, theory suggests that the short-run supply curve is perfectly inelastic.

Firm entry must be considered also. Farmers will wish to enter the egg industry whenever prices are high enough to cover minimum average total costs. If farmers wish to enter the egg-producing industry, they can do so in only two ways: buy chicks in the spring or buy old hens for a second year's production. Old hens are usually purchased in late fall when old producers are making room for new pullets. By late fall, then, farmers have made their decisions as to whether they will enter the egg-producing industry or not; and, if so, they have determined the size of their flocks. Pullets have become hens and old hens have been either maintained for egg production or sold for meat. Therefore, the number of hens cannot be increased after late fall until farmers again make their decisions, which occurs by the following fall.

When farmers decide to enter the egg industry or not and the number of hens to house they pay much attention to the past profits of egg producers. If profits were relatively high during the last production period, producers may be expected to expand their operations and new producers may be expected to enter the industry, and conversely.

Given a certain change in profits, the corresponding change in the number of hens housed during the following production period will depend upon the variation in the minimum points of average total cost (ATC) among producers. And a variation in the minimum points of average total cost would seem to be assured by variation among egg producers with respect to plant size, level of management skill, and the degree to which alternatives affect egg producers. In brief, it seems reasonable that the number and size of flocks will vary with egg prices, costs remaining constant.

As has been pointed out previously, egg producers will continue production as long as egg prices cover feed costs or until the end of the production period. If egg prices fall sufficiently, some egg producers would stop production which in turn would affect egg prices as well as feed costs, i.e., the relationship between feed costs, egg prices and production would become one of joint determination. However, egg prices would have to be very low before such a situation would arise. Using average prices of poultry ration for Minnesota for the years 1954, 1953, and 1952, the optimum feed input—egg output relationship for egg production suggested by F. B. Morrison,[5] and assumed levels of egg prices,

[5] *Feeds and Feeding*, twenty-first edition, page 1059.

it was found that egg prices would have to be less than 14 cents a dozen before feed costs would not be covered. Egg prices have not been this low in Minnesota since 1940 and, of course, feed costs were much lower then.

Apparently, egg prices would have to be extraordinarily depressed before feed costs would not be covered. Therefore, it will be assumed that the joint relationship between egg prices and egg production resulting from an exodus of firms during a production period is negligible.

In the foregoing analysis, it has been hypothesized (1) that egg price and output in any one production period are not jointly determined,[*] and (2) that the slope of the short-run supply function will depend upon the variations among egg producers with respect to average total cost, since the MC curve of a firm is perfectly inelastic over the relevant range of prices. If these conditions obtain, it seems probable that the short-run supply curve is inelastic.

The Econometric Model

In a recursive system, some endogenous variable is determined completely by predetermined variables (i.e., exogenous and lagged endogenous variables). An apposite example of a recursive system is the production and consumption of wheat. The number of acres seeded to wheat is undoubtedly a function of past prices. Even during harvesting, if wheat producers decide not to harvest wheat because of low prices, one can be sure that the price quotations came before the decisions not to harvest wheat.

The important point in the above example is that the relation between price of wheat and quantity supplied is one of unilateral causal dependence. Prices that determine production are not influenced by the amount of wheat produced. The economic organization of egg production in Minnesota suggests that the relationship between egg price and output is also one of unilateral causal dependence. Now Wold has shown that a single-equation, least-squares estimating procedure is a legitimate method of parameter estimation for a recursive system such as has been described.[7] Hence, a least-squares analysis will be employed here to estimate the parameters involved.

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[*] It should be emphasized that this analysis is concerned with the behavior of egg producers in Minnesota. Whether or not one can draw inferences from this analysis as to the supply behavior of egg producers in any other area is a question which the authors have not investigated. It has been suggested, however, that the unresponsiveness of egg production to egg prices during the production period is a phenomenon not found in the commercial egg producing areas such as the Northeast. For instance, see *Impact of Price Expectations and Uncertainties on Decision Making by Poultry Firms*, T. C. Morrison, G. G. Judge, E. H. Tompkins, Storrs Agric. Exp. Sta. Bul. No. 320, p. 19.

[7] *Op. cit.*, page 12-15.

The regression equation chosen is of the following form:

$$X_1 = \alpha + \beta X_2 + \gamma X_3 + \delta X_4$$

Twenty observations were used, from 1935 through 1954, where:

X_1 = Production of eggs in Minnesota during a 12-month period from October, year t, to October, year (t+1).[8] This is the only endogenous variable—all others being predetermined.

X_2 = Average price of eggs per dozen in Minnesota during the first nine months of the year t.[9] Both X_2 and X_3 were corrected for changes in price level by dividing them by an index of prices received by farmers. The index used was an average for the first nine months of year t.

X_3 = Average price of laying mash per cwt. for the United States during the first nine months of year t.[10] Appropriate data could not be found for Minnesota for the twenty observations. For years when the price of laying mash for Minnesota could be found, there was a very close relationship between prices of laying mash in Minnesota and prices of laying mash in the United States.

X_4 = Total eggs laid per 100 hens on the first of each month for year t.[11]

In any econometric analysis, the investigator must rely on *a priori* knowledge of the industry and economic theory to specify the type of relationship between the dependent and independent variables. And that has been our procedure here. X_1 and X_2 are made dependent and independent variables, respectively, for reasons that are obvious from the foregoing analysis. Further, since profit is a function of input prices, as well as output prices, X_3 is included in the model to take account of changing feed prices (i.e., to remove the influence of changing feed prices on the relationship between X_1 and X_2).

Although many variables have tended to shift the supply curve, one way and another, the supply curve has shifted to the right mainly because of improved technology. Eggs per hen, a reflection of genetic technology, better feeds, improved equipment, and medicine, have been increasing rapidly year after year. The variable X_4, then, is included in the model to account for the expanding supply curve. And X_4 is considered to be predetermined—predetermined by past profits—hence is included here as an independent variable.

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[8] *Minnesota Agricultural Statistics*, 1945-1954.
[9] *Ibid.*, 1938-1954.
[10] *Crops and Markets*, USDA, 1949 and 1955 publications.
[11] *Minnesota Agricultural Statistics*, 1945-46 and 1953-54.

Profits of alternative enterprises, it may be argued, also affect the position of the supply for eggs. But the competitive importance of such enterprises as dairy, hogs and turkeys was not deemed sufficiently great to merit inclusion in the model. And, although broilers might be considered an important competitor of the egg industry in Minnesota, G. P. McClosky has this to say: "Let me point out right here that it is a mistaken idea to think that farmers can be both broiler producers and egg producers. The broiler business is well in hand by nonfarmers—men who devote their entire time to it."[12] It appears that egg producers may have very few alternatives. Thus competitive enterprises are ignored in this analysis except that prices of eggs and of mash are deflated by the index of prices received by farmers.

Although it is known that the supply for eggs has been shifting to the right, it is not known whether the slope of each supply curve has remained the same. The slope of the estimated supply curve will be useful only if the variation in the slopes of the supply curves from year to year is small.[13]

It is hoped that the formulated model includes all of the important influences. The equation is assumed to be stochastic in that disturbances (i.e., unexplained variation of the dependent variable) are randomly determined by a myriad of variables, any one or combination of which, if included in the analysis, would be unimportant.

The Estimates

The estimating equation with the standard errors shown in parentheses below the coefficients, and the coefficient of multiple determination are given below:

$$X_1 = -2066.47 + 92.09X_2 - 940.53X_3 + 10.35X_4$$
$$(40.82) \quad (534.31) \quad (1.54)$$

$$R^2 = .94$$

The price elasticity of supply is given below:

$$E_p = .46$$

With a 1 per cent change in price, the quantity of eggs supplied by Minnesota farmers is estimated to change by approximately .5 per cent in the same direction.

Since time series data were used, tests of significance are not strictly

[12] "Why the Midwest Egg Dilemma?" *Poultry Processing and Marketing*, Feb., 1954, p. 18.

[13] Willard W. Cochrane, *An Analysis of Farm Price Behavior*, The Pennsylvania State College, Progress Report No. 50, May, 1951, p. 17.

valid, but must be viewed as approximations of the probable sampling variability of the estimates. The X_2 and X_4 coefficients are significant at the 5 per cent probability level. The X_3 coefficient is significant only at the 10 per cent level, hence must be accepted with more reservations.

Some analysts, when conducting research of this type, try different models in an effort to choose the model that best yields the expected results. And this may at times be necessary; the development of preliminary models often helps the investigator get a feel, or understanding, of the system for which the parameters are being estimated. But as C. F. Christ argues:

"The statistical theory, on which the least-squares and limited information estimates . . . are based . . . assumes that the form of each equation has been chosen before the data have been seen, so that the data have no chance to influence that choice. . . . But suppose that experimenting has been done and the form of the equation has been chosen in the light of how well it fits the data in comparison with other forms. Then one is more likely to get a good fit simply as a matter of chance than if one tried only one equation-form, because one has several opportunities to choose from instead of one."[14]

In this particular analysis only one econometric model was developed to yield estimates of the parameters of the sector of the economic system under consideration. That model was deemed by the authors to represent adequately, if not perfectly, the supply relation in the egg-producing industry of Minnesota prior to the actual work of estimation, *and it still is.*

The signs of the regression coefficients are what economic theory suggests. Both the egg-price and technological-variable coefficients have positive signs. The laying-mash variable coefficient has a negative sign. In general, although the assumptions have been many, the approximations rough, and the model relatively simple, the parameter estimates seem reasonable and internally consistent.

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[14] "Aggregate Econometric Models," *American Economic Review*, June 1956, pages 400-401.

MR. GRAY ON CARICATURE

J. K. GALBRAITH
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MAY I offer a brief observation on Mr. Gray's article, "Caricature and the Orientation of Agricultural Economics," in the last issue of this *Journal*, although I am not sure that it is completely necessary.

Caricature, as readers will have recognized, is Mr. Gray's invention. We can only speculate as to why he was led to employ such a curious tech-

nique of debate and I trust that my contributions will not drive others to such expedients. It will be observed that he avoided all questions of substance; his only objection was to my language. This would have been most appropriate had my meaning been obscure. But my recent observations on agricultural policy and the position of agricultural economists thereon were couched, as he concedes, in plain and lucid English. My characterisation of the policy views of leaders of the profession in "Preconceptions and the Farm Policy (*American Economic Review*, March 1954) was based primarily on "Searchlight on Agriculture." Subject to the footnotes, the views set forth in that booklet were subscribed to by thirteen leading members of our profession including seven past presidents of the American Farm Economic Association. I quoted these views at some length; to let men speak for themselves is an elementary precaution. It excludes not only misrepresentation but anything that could remotely be called caricature.

The article on agricultural policy Mr. Gray mentions was published in this *Journal* ("Farm Policy: The Current Position," May 1955), and it had been given as a lecture the previous December before the Graduate School of the United States Department of Agriculture. My central conclusion concerning the then recently enacted farm legislation was stated in these words: "Under the new farm bill the country can reasonably expect to have all the troubles that afflicted it under the old one. Despite all the effort, no substantial problem of past farm policy was solved or greatly mitigated." There was no caricature here. There was (which I assume to be the real point) immediate and vigorous objection. Dr. O. C. Stine challenged my conclusion at some length in the pages of this *Journal*. ("Professor Galbraith on Farm Policy," February 1956.) Bluntly stated conclusions, even when unpalatable and in conflict with the accepted views, are not caricatures. Events may also deal more kindly with dissent than with fashionable agreement. Since 1952 farm prices have fallen 15 per cent; farm surpluses have incresed threefold; the dollar cost of the farm programs has risen greatly.

I would conclude, though I cannot be sure that he is aware of it, that Mr. Gray's objection is really to the blunt truth and plain language. This is what he calls my "unique idiom." There is further proof of the point in the fact that he refers to my criticisms of policy attitudes as "tirades." Tirades are well understood to mean "intemperate and, usually, vituperative or harshly censorious language." Since Mr. Gray has qualified himself as a stylist, we must assume that he chose his word carefully. But does anyone really think it applies? I confess that I rejoice at least as much in afflicting the comfortable as in comforting the afflicted. But this involves no intemperate mood or language. By tirade then, he means only something he doesn't like. It is, in short, a synonym for caricature.

He concludes by suggesting that my "caricature" should be taken as seriously by the profession as other people's slogans. I appreciate this support even though I had not been completely aware of its need. I am regretfully forced to reject it nonetheless. I would not equate clear if unpalatable English with slogans. Nor, I think, would any other scholar.

THE SADDENING VISTA OF THE SAWDUST TRAILS

PAUL E. ANDERSON
Francis I. duPont and Company

ROGER W. GRAY'S caricature is very satisfying to read.[1] His discussion performs a fitting service; it turns caricature and caricaturist back on the subject. As policy study has been riding off in all directions at once, how arresting to have someone show that we, too, are also running away together. Some like Galbraith, perhaps, run with a mocking, though somewhat funereal air; some like Shepherd travel in a faint pontifical aura. Alas, too, too many move in the ponderous god-like air—of course on the level of the little gods of the mole hill social science. Mr. Gray, standing at the forked policy road, seeing all too clearly Dewey's two sawdust trails, is frozen in the posture of the caricaturist turning back on himself. It could become very refreshing.

All along many of us thought we were travelling a most glorious highway. At the end, it would be paved with gold and drenched in the sunshine of glittering analyses. Though now we deal with problems immeasurably beyond our scope, eventually, with our metallinguistic abilities, we would unquestionably come into a land of perpetual noonday and five Fridays a week. Alas, poor analysts, we find our endeavors to be like the nothing we set out from, and we make haste to hide the expressions of our brashness in symbols and data. But though we glimpse the appalling chimaera of our reflections, we dare not face it.

Mr. Gray, however, is not merely content to caricature; he is gifted with such insight and good sense that he realizes in the very act of caricaturing another caricaturist, our common, our altogether woeful plight. Truly it is not a happy one! When the gods are toppled, who is there to take their places? He recognizes what we are doing when we caricature: we are turning on ourselves and seeing, at last, the projection of our disappointment, our frustrations, our resounding ignorance, full of words and symbols signifying nothing. He notes that we resort to invective because we are projecting the hatred born of our discomfort. Ah, those fancy adverbs! They cover up much in their sound and fury, even if the much is much of nothing. We criticise because we can no longer bear

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[1] Roger W. Gray, "Caricature and the Orientation of Agricultural Economics," *Journal of Farm Economics*, Vol. XXXIX, Feb. 1957, pp. 1-7.

the self-same tendencies to inflate one's ego in the other fellow. We are
scientists. But we have deep hidden doubts, for behold our personal be-
liefs, our opinions, yea, verily our superstitions, enmities, egoistic con-
ceits and inflations, in all we do!

Ah, what better way than caricature, or perhaps the mouthing of the
dogmas of our fathers? Ah, but, modern scepticism brings us up short.
We catch a glimpse of something veiled, and like a little boy resorting to
the ancient creed of our cult, or fearful of seeing what he is really doing
and being unable to rationalize, excuse it, lie out it.

As we lack the wonderful simpilicity set out in Pascal's *Pensee* 66, we
are unable to see why we continually strive to deal with what is im-
measurably beyond our scope. Though we travel through the veritable
maze of symbolics and meta-linguistics, we at last find ourselves at the
same bourne mentioned by many before us, most notably in the symbolic
language of Wittgenstein. There we sit on the nearer shore wringing
our hands and longing for and weeping for the further shore. Not all
our wit, nor all our logicising, nor all our meta-linguistics, can tell us the
simple way out: how can the unknown, which is without scale and mea-
sure and form and void, be evolved from the known? Our data and sym-
bols, our symbolics have truly paid off, but the pay-off has all the nothing-
ness implicit in their beginning. All the while we beguiled ourselves with
the operational tests of making simple propositions complex and broadly
representative, forgetting that any proposition may be asserted and may
meet all the tests of truth simply because it has been designed merely to
achieve economy in operational procedure.

Have we not been evading our ignorance of ourselves? Doing that,
unwittingly, how do we expect ever to come up with anything valid?
That which is not identifiable with our egotistic SELF-assertiveness. May
one speak of non-egotism when the experience of it is outside expression
in words or symbols?

Our dilemma, it appears, is a very ancient one! We might go away
back, but we may mention Socrates and Plato. They were, as we well
know, relentless in their questioning of men and women on their symbols
and data. Almost always they drove them to the point where men came
to realize the nothingness of their symbols and data, the very emptiness of
all their content. Socrates and Plato, we may say in all humility, tried to
bring individual men to look upon that final illusion to which, when
stripped of all the data and symbols they lived by and for, they still
clutched. It is still the very illusion with which we men to-day fill our
world.

Brought to this pass, men could look upon the sawdust trail leading off
into the wild blue yonder, and yet try to convince themselves it led to
something somewhere because they projected this upon the barren scene.

Or, perhaps, looking upon the scene before them, some men might have been able to penetrate the veil of their projection and look where they had never thought or known to look before. Then they could well have recognized that they projected the scenario which they acted; and they made it the fearsome thing it was; which we now also make.

Plato and Socrates performed quite another service. It is often missed by us moderns. Did they not draw a panoramic caricature of the attempt by meta-linguistics to create the *model* of a perfect commonwealth. It was an astonishing model. In that ideal everyone had his appointed place, everything was pre-planned. For the master planners on top, the so-called lovers of understanding, or wisdom, everything existed. Is this not the very self-same direction towards which all models implicitly move? Nowadays we might call it by a different name, a more semantic name, but the basic principle and direction is identical: it is the model that should develop from what we term "well-oriented policy."

Yet, nothing basically is changed in the model. Greed is still prevalent. Men hate one another and in their haste to make a name or place still are ruthless. War is still, as it was in Plato's model, the same horrifying and terrible instrument of hatred and jealousy. Even among the men at the top of our ladder, the directors and planners, there is also jealousy, such as the jealousy among those in the *Republic* and among the ancient gods. Yet, do we understand the illusion? Namely, that in the model of Plato and Socrates, there was everything except the one realization, namely that which both men tried to make evident to those they questioned?

Aristotle, later, touched on this plight in a more direct manner. Seeing man's difficulty, he turned to man's psyche and studying it saw that it was something that developed under conditions which he called *ta meta ta physica*—the inner world of man that lies beyond the natural and the physical. It is from its material that man makes, projects, his models of the world, forms his relationships. Here, from his terrors, his fears, his concealed, but terribly active life—his illusions—he projects all his world. Deep down, buried, lay that something which we nowadays call or should properly call "Objective Conscience." By whatever name, it remains untouched by inner activities until activated by the means that Pascal explained.

Is is strange then, that Aristotle in touching on what we call economic activity, which to Aristotle was a part of all man's activities, placed in the very center of such activity the *Household*? This is a relationship which is immediate to all men. It is not a policy, nor a result of policy. It is not a system, nor formulated in a system. Neither is it a method, nor yet a model, nor a planned arrangement. It is beyond the natural and the physical. Yet in it are envisaged all that comes out of economic activity, the division of labor, the right allocation of resources, programming of activities, conser-

vation of the common wealth, continuity and a common endeavor for the objectivity of good life. All these and more are indigenous to the Household. In most of the commentaries on this notion, is it not singular that the obvious reality of the household is overlooked? Namely, can there be a household without love? Or any relationship of an enduring and creative kind without love? Is not the household born of man's objective conscience, of its recognition of the equality of meaning of all its members? There is neither caste nor class in it, only love.

The world of our relationships is our projection; as our world is made of horrors, may we not conclude that it is the product of the offspring of the sowing of dragon's teeth? We are all in flight. What do we run from? Is it not ourselves? Our fear that we may see that we have projected a policy and made a model of hate; crying in terror against what we have done. We have forgotten love and its motivator, conscience. . . . Is not this the nothingness to which we have come, the caricature which we are so fearful of? We dare not look because we know we shall see how the *Self* has filled the world with its myriad guises and none of them is real. So it will not allow us to look beyond its manifold veil into the reality that is not to be explained, nor analyzed, nor constructed, nor modeled, nor achieved by any means a policy; but nonetheless *is*. We have gone a long way. In our journey, we have all but forgotten what we had in the beginning: the fullness of understanding which needed no explanations nor symbolic treatment, Love. Is this not what the Household should imply in our activities, something that is beyond the natural and the physical, that is beyond the Self with which we are puffed up and vaunting?

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"World Grain Trade Statistics," FAO, Rome, Italy, November 1956.

REVIEWS

Who's Behind Our Farm Policy, Wesley McCune. New York: Praeger, 1956, Pp. 374. $1.50 (paper).

Agricultural economists are accustomed to admit, usually with regret, that they don't make federal farm policy in the United States. Who does?

All sorts of people—even a few economists—are involved. But the main point Wesley McCune makes is that among those who try to make farm policy are a surprising number of business men.

Farmers often talk among themselves about how to make city people, including business men, more conscious of farm problems. Apparently a good many business men are already doing a persistent and skillful job to make farmers conscious of the business point of view.

McCune presents a detailed review of the instances in which business groups have worked with or "infiltrated" farm organizations. He also describes a number of "educational" concerns, some of which are apparently designed to show farmers a picture of the world as business would like farmers to see it.

These business activities range from the scandalous to the innocuous. An example of the first class is the classic case just after World War I when a Farm Bureau official tried to turn Muscle Shoals over to a private concern. Examples of the second class are the hand-outs given to 4H and FFA youngsters by various corporations.

McCune pays a good deal of attention to the membership and policies of such groups as The Farm Foundation, The Foundation for Economic Education, The Foundation for American Agriculture, the Sears-Roebuck Foundation and the National Institute of American Agriculture. What interests him particularly is the way in which representatives of the same big business concerns keep showing up on the boards of these and similar organizations. Sears Roebuck, for instance, has representatives on six groups of this kind.

It should be noted that not all of this business activity is inspired by business. McCune gives a lot of credit—if that is the word—to experts in public relations who sell corporation executives on schemes of this kind.

One method, apparently is to go to a big executive and say, in effect: "Wouldn't you like me to fix things so farmers would love you—and would also think the right kind of thoughts about politics and economics?" Enough say "Yes" to make a good living for several experts.

A less subtle approach to farmers is provided by the U. S. Chamber of Commerce, the National Association of Manufacturers and smaller business groups. These organizations usually have a good deal to say on farm policy.

To what extent do these nonfarm business activities help to form

federal farm policy? McCune traces the relationship of the American Farm Bureau Federation, the National Grange, the Farmers Union, the National Council of Cooperatives and others to business groups.

Here it should be noted—as with any book—something about the author's background and biases. Very probably every agricultural economist who writes a book on farm policy should point out where he was brought up, whether he was blighted by the thirties or burst into bloom in the forties, and what organizations he has worked with.

Wesley McCune was an assistant to Secretary of Agriculture Brannan, has worked with the Democratic National Committee, and is friendly to the Farmers Union. For years he has cast a critical eye on the ways in which "city cousins" try to influence farm policy. His earlier book, *The Farm Bloc*, made some of the same points he makes in this new book.

The conclusions McCune draws from the data he presents may not agree with the conclusions of every reader. Yet his listing of the various ways in which city business tries to influence farm people is useful information for anyone. Like Charles M. Hardin's, *The Politics of Agriculture*, McCune's book throws a good deal of light on why and how ideas about farm economics get turned—or twisted—into law.

Farmers especially will be astonished to learn how much effort is being made by business to influence farm thinking. Alongside what business is doing, the efforts of some farm groups to tell their side of the story to city consumers seem half-hearted indeed.

DONALD R. MURPHY

Wallaces' Farmer and Iowa Homestead, Des Moines

Managing the Tenant-Operated Farm, James J. Wallace and Raymond R. Beneke, Ames: The Iowa State College Press, 1956, pp. viii, 264. $4.50.

Managing the Tenant-Operated Farm should enjoy a wide nonacademic as well as academic readership. This likelihood is enhanced by the authors' choice to discuss the various problems and issues nontechnically. The result is highly readable yet reasonably informative.

The senior author is manager of 12 farms of the Iowa State College Agricultural Foundation. They range in size from 120 to 320 acres. He draws on his experiences with these farms, operated for income, for suggestions in handling problems faced by nonoperating farm owners. The junior author is Associate Professor of Farm Management, in charge of undergraduate teaching in Farm Management at Iowa State College. The book is oriented (understandably) to management problems found on Midwest corn-belt farms.

The 259 pages of text are divided among 18 exceptionally well-organized chapters. In chapters one and two, the authors treat, respectively, why and how one buys a farm for investment (or, briefly, hobby) pur-

poses. Thereupon they turn to the problem of managing the farm, how-
ever acquisition is accomplished. Income motivation is assumed for the
farm owner.

The authors present two alternatives to the nonoperating farm owner:
(1) direct management, with either a tenant (chapters three to sixteen) or
with hired labor (Chapter 17), and (2) indirect management, with the
use of a professional farm manager (Chapter 18). As the title suggests,
they concern themselves mainly with the first alternative, though interest-
ing suggestions are offered on the intelligent selection and use of hired
labor and of professional farm management services. The following com-
ments are restricted to materials in chapters three to sixteen.

The most important decision of the nonoperating farm owner who
elects to manage his farm through a leasing arrangement lies in the
selection of a tenant. This is not a problem to be solved by formula. Yet
certain practices will help reduce the probability of unwise selection.
And it is most important to assess correctly the facets of the problem. The
key for the owner is to match the tenant with the farm and with his own
personal and financial characteristics. A review of suggestions offered by
the authors on these points might well save the farm investigator con-
siderable trouble.

Management of the tenant is discussed further in chapters four and
five, wherein alternative leasing arrangements are developed for Midwest
conditions and the delicate and highly important problem of landlord-
tenant relationships is handled. Again, few formulas are available to use
in these areas. But there are numerous practices which, if used intelli-
gently, can reduce the chances of trouble.

In the next six chapters, the authors are more specific and their ma-
terial more restricted in geographic application. Land use and cropping
systems are discussed in chapters six (crop selection and rotation), seven
(profitable use of fertilizers and related practices), and eight (soil con-
servation practices). In these three chapters the authors come closest to
"textbook" use of economics. Yet the treatment is still nontechnical and
well illustrated with specific examples. Always they are careful to adapt
relevant principles to the case of nonoperating farm owners.

In a similar manner the selection and management of livestock are
discussed in chapters nine and ten, respectively. Some rather specific
methods and solutions are offered for management problems relating to
hogs and feeder cattle. Chapter 11 comprises a short chapter on man-
agement of purebred livestock. It is too scanty to be of much real help.
Yet more extended treatment would be hard to justify on the basis of
importance to farm investors.

Two methodological chapters are included—and, curiously, are sep-

arated in the book. The budgeting process is described in Chapter 12. Rather standard budget forms are adapted to the rental situation. They provide a clumsy means for handling expenses in "The Crop Plan" (page 172) and an inadequate means for listing "other" (than feed) expenses in "Feed and Expense Summary for Livestock" (page 174). Records are treated separately—conceptually as well as spatially—in Chapter 16. Both of these chapters might have been strengthened by relating them more closely. The records suggestions are likely too formal for most nonoperating farm owners. They are developed, apparently, with a view to the owner with several tenants. Further simplification would surely be feasible for the owner with one tenant. The widely-used multiple-column journal is neglected in favor of a journal for entering items under "Operating Expense," "Income" and "Capital Expense." Adoption of the authors' suggestion on the journal would certainly create more work in record keeping without having compensating advantages.

Special problems of particular importance are handled in chapters 13 (the development of a run-down farm), 14 (the development, maintenance and abandonment of farm buildings and improvements), and 15 (insurance). These chapters are excellent. In Chapter 13, a Foundation farm is used as a case example to illustrate important points. Chapter 14 could have been expanded a bit for purposes of this book. Yet the treatment is good. In 15, the authors go too far in stating that the purchase of insurance depends on the consequences of loss. This is, after all, only one of three determinants (the others being the incidence of the event and the premium cost), even though it is an extremely important determinant.

In summary, the book is well done and contributes to a gap in the literature in farm management. As the ownership of farm properties by nonoperators increases, one might predict an increasing interest in this book and in other related literature yet to be produced.

C. B. BAKER

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"*Must Men Starve?*", Jacob Oser, New York: Abelard-Schuman, Inc., 1957. Pp. 331. $4.50.

"Malthusian doctrine has the odour of decay and death about it" says Professor Jacob Oser in his book *Must Men Starve*. He then provides us with a criticism of Malthusianism and the apologists for hunger in a world where agricultural resources are only partially or inadequately utilized. Taking the major arguments of those who have postulated that "the increase in population tends to exceed the ability of the earth to support it" he refutes them with documentary evidence. Obstructions to increased income, farm production and food consumption have been

created by faulty social relations and political and economic institutions. Tariffs, quotas and production controls have been used to further the interests of particular groups or countries.

Malthus considered war as one of nature's remedies for overpopulation. Modern Malthusians regard population pressure as an inevitable cause of war. War solves the problem of population pressure and poverty by killing off large numbers of people. As the author indicates, however, warfare destroys a larger percentage of wealth and income than it does people. Warfare is a major cause of overpopulation and poverty. The poorest and hungriest people have been the least warlike in international affairs.

Systems of land tenure in colonies and protectorates throughout the world have deprived natives of needed land for cultivation or have placed restrictions on the type of product grown. Profits for owners have been given precedence over nutritional gains for workers. The Middle East is an example of semi-feudalism and absentee owners. There is little or no security for the tenants, therefore little incentive to improved farming. Money lenders, as the chief sources of credit, extract up to 100% interest on farm loans. Similar criticism can be made of India and Pakistan where the land is controlled by a few, and Latin America where a similar land ownership pattern is a serious obstacle to technological improvements in agriculture.

The underdeveloped countries show great seasonal swings in unemployment. Labor is in surplus supply. Farmers in the Philippines average 136 days of unemployment in a year, in India 165 days, and in Ceylon 4½ months. The average farmer in Egypt works 6 months per year. Everywhere people occupied in agriculture produce less than their per capita share of the national income. An Iranian farmer takes 16 hours to produce cotton that a United States farmer produces in one hour.

Terms of trade have tended to discriminate against the underdeveloped areas. Prices of raw materials fluctuate widely, bringing hardship and inefficiency in resource use. A "League of Undeveloped States" is needed, says the author, to fix the prices of its exports and to prevent exploitation under international commodity agreements that tend to favor foreign owners of mines and plantations. A well balanced program of industrialization would assist in increasing agricultural output.

Unfortunately, commercial policies of the U. S. and Western Europe continue to retard manufacturing in the countries supplying raw materials. Oil-seed producing countries for example do little of their own crushing. Cocoa beans are shipped to industrially advanced countries even though 50 per cent of the weight could be eliminated if cocoa butter instead of beans were shipped. There is a shortage of private long-term capital for industrial development. When it is available undeveloped na-

tions receive the kind of investment that tends to perpetuate them as exporters of raw materials and importers of finished goods.

Practices of foreign corporations in underdeveloped areas, wage rates, methods of taxation, and terms of trade are fundamental obstacles to rising standards of living, and the illustrations are numerous.

Finally, in order further to refute Malthus, Professor Oser gives us an insight into the known methods of increasing food production, the untouched resources of water and soil, and the impact of science on the future developments in backward countries. The mores, customs and religious obstacles to increased food production pose problems peculiar to each country. The social structures of the underdeveloped countries must undergo change if the human and agricultural resources available to them are to be used adequately.

The breadth of the subject has, of necessity, resulted in the author covering a great variety of subjects and references from one point of view. For those who do not agree with the conclusions there are many monographs on Malthus on the library shelves as well as opportunities to refute the arguments. The book has vision and is written with imagination. Countries of the Western Alliance can well take note and adopt policies of foreign investments and trade that recognize the shortcomings of the past.

A more imaginative and forthright policy of improved living standards through industrial and agricultural development by the United Nations and by more liberal trade policies from the West, will do much toward putting Malthus back on the shelf where he belongs. Unless our present policies are changed, however, we shall be forced to quote from him again or, what is more tragic, allow Communism to supply the answers.

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Food: Volume II, Studies in Administration and Control, R. J. Hammond. London: Her Majesty's Stationery Office and Longmans, Green and Co., 1956. Pp. 836. $9.00. American Agents: British Information Services, 30 Rockefeller Plaza, New York 20, New York.

General readers may find this second volume of the history of British wartime food control less interesting than the first. This volume deals at length with the administrative aspects whereas the first traced the growth of food policy. But students of government and all who participated in U. S. wartime food administration will be enthralled by the series of studies that trace the vicissitudes of controls over fresh fish, eggs, potatoes, and milk. These form the first third of the voluminous book. The second part of the book deals with emergency and communal feeding and could serve as daily lessons for U. S. defense planners today.

The chapters on rationing as an administrative problem seem somewhat long-winded, but Mr. Hammond, being a skilled historian, does not give the details simply to fill out the pages. He is taking the reader relentlessly through the history of the British rationing system in World War II to reach the same conclusion arrived at by Beveridge after the World War I period of food control, "If the story shows at many points how rare a human quality is foresight, it shows also how lack of foresight can be atoned for, given luck and time and determination." (Hammond, pp. 757-8. Sir William H. Beveridge, *British Food Control*, p. 332.)

Hammond has carefully provided in Volume II adequate background information on the development of British food policy so that it can be read without immediate reference to the preceding volume. However, to refresh the memories of potential readers of the new work, here is a brief listing of the subject matter already covered: (1) prewar planning; (2) development in 1939-40 of the second Ministry of Food and its handling of import problems, its struggle with the Ministry of Agriculture over home production and prices, the beginning of rationing, and the early difficulties with transport and warehousing; (3) the period of 1940-41 when one crisis overlapped another; and (4) the years 1942-45 which are of particular interest to Americans because of the interdependence of British and U. S. food policies and programs.

Time and again as Mr. Hammond sorts out the complicated interplay of administrative, trade, and political forces on food control policies and programs, he reminds us of geographical problems and of the industry or civil servant background of the wartime food staff. For example, the main body of the Ministry of Food operated from Colwyn Bay, Wales, on the Irish Sea near Liverpool. The Potato Division and at various times the Fish Division and those dealing with jam, pickles and sauces were at Oxford. The Imported Cereals Division was located in a village south of London and was operated from the home of the Director because he refused to move. Liquid Milk had headquarters at Thames Ditton, in Surrey near London, but Condensed and Dried Milk operated out of Colwyn Bay.

No doubt the accounts of disorganization and extemporizing by the British Food Ministry will provoke as many memories of similar experiences for other U. S. wartime food employees as they did for me. Perhaps this element, as well as the great skill of historian Hammond, explain why the first two parts of this book read like a novel or first class mystery.

It is quite fitting that two of the four monographs deal with fresh fish and potatoes, known to all Britishers and visiting Americans as "fish and chips." I will not recite the tales of initial misfortunes and dogged recovery, but I must question the author's incidental statement that fish

played a small part in the wartime diet of Britain. The First Report of the National Food Survey Committee, *The Urban Working-Class Household Diet, 1940 to 1949,* provides data on page 20 indicating that the poundage of purchased fish in all forms varied from 20 to 35 percent of the total meat poundages consumed during the war years. Failure to weave in the findings from this valuable survey is the only significant omission that I have noted in Hammond's two volumes.

British experiences with rapid shifts in potato supplies from gluts to shortages are reminiscent of comparable U. S. problems. All who have eaten very long in British homes and restaurants will understand the serious nature of these swings in supplies. Furthermore, potatoes were and are the principal source of Vitamin C in the British diet. Hammond concludes his study of potatoes thus (p. 168): "The real lesson of potato policy lies just in that fact; the potato shows very sharply the danger of too great a reliance on home-produced food. Ability to maintain imports is, in our present state of knowledge, the only safeguard against famine."

The second part of Volume II, on emergency and communal feeding, should be required reading for present and future defense planners, for American legislators, and leaders in the eating-place industry. For example, the experiences at Coventry and at Plymouth point to the use of disciplined military units as the best solution to the first-aid emergency feeding problem after catastrophic raids, but only on a short-run basis. Hammond even describes the pigeon, telephone, teleprinter, Queen's Messenger, and despatch-rider arrangements for carrying food news. He frequently refers to the fact that emergency situations were handled best by local or divisional food officers who went beyond their rule books to improvise and whose leadership ability was usually the key to the successful coping with crises.

Despite my earlier note that the rationing chapters of the book are inclined to be long winded, I still consider them to be well worth reading and studying. The British systems of consumer-retailer ties and of controls of supplies prior to the retail level were so very different from the U. S. rationing set-up that American readers can gain fresh insight into basic problems of administrative control over distribution. British people generally regarded food rationing as quite successful. But Hammond apparently believes that a system of ration currency, such as that used in the U. S. and for tea in Britain, would have overbalancing administrative advantages. He remarks about British food officials, "The contrast between their ingenuity and perennial freshness in device, and their reluctance to bring sustained criticism to bear on basic notions, is a striking feature of British food control" (p. 757).

Hammond concludes that his account of the processes out of which

developed the administrative forms and documents for the Second World War "will be justified, practically speaking, only if it drives home the warning that the most dangerous legacy a rationing scheme can leave behind is a collection of its forms and instructions. Precedent is the uncritical recourse to history . . ." (p. 759).

This over-all view of British food administration highlights the inadequacy of the commodity monographs issued by the U. S. Department of Agriculture and emphasizes the need for the publication of a similar impartial, analytical study of U. S. wartime food policies and administration.

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American Farm Policy: The Thirtieth Discussion and Debate Manual 1956-57, Edited by Bower Aly and Edward A. Rogge, Columbia, Missouri: Lucas Brothers, 1956, Two Vol., Pp. 252 and 220. $4.00.

The great debate on American Farm Policy continues, not only in the halls of Congress, but also in the secondary schools throughout the land. This state of affairs has not been due to the violent impact of declining agricultural incomes upon the school system, but rather that the major problem chosen for discussion and debate for the 1956-57 year is: "What agricultural policy will best serve the interests of the people of the United States?" This problem comprehends three discussion questions and three debate propositions as follows:

Discussion Questions

1. What should be the policy of the federal government in regard to price supports?
2. What should be the role of government in the conservation of soil resources?
3. What should be the policy of the federal government in regard to agricultural surpluses?

Debate Propositions

1. *Resolved:* That the federal government should adopt the basic principles of the Brannan Plan.
2. *Resolved:* That the federal government should sustain the prices of major agricultural products at not less than 90 per cent of parity.
3. *Resolved:* That the federal government should remove from use sufficient acreage to balance agricultural production.

The two volumes here reviewed are by their own modest standard "an introduction to the foregoing questions and propositions."

Volume One of the Manual consists of 20 specially written articles

presenting various views on agricultural policy or certain factors of importance to it. The authors vary from the president of the American Farm Bureau Federation to the current editor of this *Journal*, with the academic outnumbering the practicing policy makers 11 to 9. Interspersed among these articles are eight short "comments in brief" varying in length from a few lines to a full page. The purpose of these may be either to make certain that everyone who had something to say on farm policy was represented, or to make certain there were no partially blank pages where articles ended.

Volume Two consists of 22 articles divided into seven sections and interspersed with 26 "comments in brief." The seven sections include: points of view, background, Republican views, Democratic views, prospects, prices and parity, and the soil bank. Much, but not all, of this material is reprinted from magazines, speeches, reports, or books. It ranges from the President's 1956 veto message returning the first farm bill and Senator Johnson's answer thereto, to "A History and Evolution of Parity" from *Can We Solve the Farm Problem* by Murray R. Benedict.

Presumably a debate manual should be judged upon its usefulness as such, rather than as a book of readings. Therefore, the useful criteria would appear to be the following: (1) Are there a number of authorities who may be quoted on the questions? (2) Is information presented on both sides of the question? (3) Is the over-all presentation biased in any direction?

The answer to the first question is yes, since 42 separate articles are included, not counting the "comments in brief." The answer to the second is less clear. The third debate proposition obviously deals with the Soil Bank Program. It is surprising and somewhat alarming to find no article questioning the soil bank as a solution to the current agricultural problem. This is particularly true in view of the general lack of enthusiasm displayed by many agricultural economists toward the program.

On the third question one gets the feeling that agricultural fundamentalism is implied throughout the document. This feeling is heightened by the quotations used to introduce the sections in Volume Two, a majority of which are of this type. This, however, may be inevitable since this is apparently the basis for much of our current agricultural policy.

These manuals probably have little new to offer as references at the college level, although some of the articles offer excellent studies in the value judgements underlying current agricultural policy. However, agricultural economists might do well to regard these volumes as something of an indicator of the state of current agricultural policy. There appears to be more differences of opinion among the nonacademic persons on the question of what is, than on what ought to be. Much of the debate by these practicing policy makers is over what farm income is, how it is

distributed, whether or not the aggregate supply function in agriculture has a backward slope, and whether a reduction in agricultural incomes will cause a national depression. Quotations from professional agricultural economists with convincing answers to these questions are notably absent, nor can I suggest many that would have conclusively answered them if included. In a country as statistically rich as ours, spending as much as we spend for economic research, we seem to have made little progress in answering many important questions. It may be too much to expect a national program to attain what ought to be in agriculture when so few agricultural economists can be quoted regarding what is.

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Food and Inflation in the Middle East—1940-45, E. M. H. Lloyd. Stanford, California: Stanford University Press, 1956, Pp. xiv, 375. $6.00.

This volume is the ninth to appear in the Food Research Institute projected series designed to illuminate the complex aspects of food, agriculture and World War II. The story the author has to tell in this book is "about the impact of the war on Middle East food and agriculture and the part played by the Middle East Supply Center (MESC), in cooperation with Middle Eastern Governments, in maintaining the food supply of the towns and averting the threat of famine" (p. ix).

An excellent account is given by the author on how the Middle East was fed during the war. His account branches out into a number of related fields—strategic, political, financial and technological—and involves a survey of data ranging over a score or more of countries. These countries include Egypt, Sudan, Turkey, Syria, Lebanon, Ethiopia, Palestine, Trans-Jordan, Iran, Iraq, Saudi Arabia, Malta, Cyprus, Aden, Somaliland and Eritrea.

The prewar food and agriculture situation of most of the above-mentioned countries is outlined and analyzed in Part I. Starting with a definition of the Middle East, the author describes the land and climate of the region; the distribution of its population; the extent of illiteracy and poverty; the types of existing land tenure; the agricultural pattern; the situation of livestock and pastoralism; the food supply and pattern of consumption; and surveys of nutritional deficiencies, calorie requirements and population growth.

In Part II the author centers his discussion on the work of the Middle East Supply Center (MESC). He starts with a statement of how war affected the Middle East; then he moves to discuss the origin of the MESC, its scope and terms of reference, and Anglo-American cooperation in this Center.

In commenting on how WW II affected the Middle East the author

states (p. 74) that "With the intervention of Italy in June 1940 the Mediterranean was closed to sea transport and supplies for the Middle East had to be shipped round the Cape of Good Hope—a distance of 12,000 miles instead of 2,000 miles from home ports." The combined resources of Germany and Italy were then very great and it seemed hardly possible that the Middle East could be defended against them. Shipping shortages and losses from submarine attacks became the crucial factors determining the fate of the Middle East. Conflicts arose between rival claims for tonnage ". . . first, between munitions and other military stores and equipment, and second, between military and civilian imports. . . . The Middle East depended for its essential imports on shipping and on sources of supply controlled almost entirely by Britain or the United States; but, if the claims of the military authorities were to be paramount and essential civilian imports were to be excluded or subjected to arbitrary interference, the strategic consequences might have been disastrous. Famine and civil unrest had at all costs to be avoided; and a reasonable degree of political stability and popular acquiescence in the war effort had to be preserved (p. 6. 74-75).

To help government regulate civilian imports and to ensure that Middle East countries would obtain their essential needs, the MESC was created in April 1941. The MESC was an Anglo-American organization whose main functions were (p. 93):

"(1) to review and coordinate the joint resources and civilian requirements in essential commodities of the territories (including raw material required for their war industries), in order to make the Middle East as self-supporting as possible, and to exchange relevent information with corresponding control organizations in each territory; and (2) to estimate the balance of any essential requirements which must be imported from outside of the Middle East and make recommendations accordingly to the authorities concerned, with a view especially to the best use of available shipping."

The staffing of the MESC together with its activities in controlling cereal imports and collection and disposal schemes are all dealt with in Part III. The procedures followed in the collection and distribution of cereals in such countries as Egypt, Syria, Iraq and Iran are also discussed in this part.

Part IV of this study deals with an economic analysis of the region which was "increasingly disturbed by military operations, by cuts in imports, and by steadily mounting allied expenditures. Then in the summer of 1941 there were poor crops throughout the Middle East and threat of food shortage in towns led to hoarding of grain and a growing flight from money into goods. From the beginning of 1942 until the end of the war, the problem of feeding the Middle East became increasingly mixed up with the issue of run-away inflation" (p. 179). Before coming to grips

with this complex the author marshals some of the data and shows what happened to money and prices in each country. His data show a fairly close correspondence in each country between increases in the supply of money in the form of currency and bank deposits and the amount of allied military expenditures during the war years. The data also show that there were divergent price levels in Middle East countries that created serious obstacles to international trade. His broad conclusion was "that in the six years 1940-45 the Middle East received about $2,500 million for goods and services worth approximately $1,000 million at 1939 prices. After allowing for a rise of world prices of about 50 percent during the war, price inflation in the Middle East accounted for nearly a billion dollars of the postwar sterling balances" (p. 192).

The author tells us also of the Middle East financial conference that was held in September 1942 to solve the problem of inflation. Resolutions passed by the conference for consideration of Middle East governments fell under four catagories (1) general, (2) taxation, (3) loans and savings, and (4) price policy and price control. However, only price control and rationing could be adopted and three chapters are set to discuss the systems of rationing in Egypt, Syria and Lebanon, point rationing in Palestine, and rationing in Iraq, Sudan and Persia. Another chapter is devoted to an account of the sale of gold at market price as an anti-inflationary measure to absorb excess currency in circulation. In this chapter there is given the first full account that has yet appeared on the subject.

Part V deals with the production and supplies of rice, sugar and other foods, and Part VI deals with MESC scientific aid for food production especially in fighting against locust and in improving methods of irrigation and dry farming and in developing better use of resources (human and natural).

The concluding part surveys postwar developments, pointing to the area's remarkable postwar recovery and illustrating the continuing race between food production increases and population increases.

In general, the author has written a very readable and illuminating account of the problems of food and inflation in the Middle East during the war. He has performed a very useful service in bringing together the details and nature of the problems involved. The book, well documented, provides useful material, concentrated in a single volume, for the student of the Middle East, and for those who wish to review the outcomes of certain policies initiated in the past. No previous comprehensive work of this nature has been attempted.

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Freedomism: Goals of a Free World, Paul A. Eke. New York: Vantage Press, 1956, Pp. vii, 292. $3.75.

To coin a proverb, "He, who so persuasively denounces the pernicious forces tending to snuff out the flickering candle of human freedom, fanneth the flame in the doing." Such is the feeling one might experience as he first reads *Freedomism: Goals of a Free World,* another valuable literary contribution to the progress of man in his gropings toward a better society. Offering freedomism as a key, Dr. Paul A. Eke, who has already distinguished himself as teacher and scholar in the field of agricultural economics during the past quarter century, launches a study transcending traditional subject-matter delineations.

Freedomism is really a treatise in philosophy in the contemporary sense, or perhaps political economy in the classical vein. It is a search for ideas about an improved theory of inquiry for personal life *and* for ways to improve the economic, social, and political organization of society. It is a search all too infrequently found in our day of specialization and highly particularized research programming.

The author is worried about the prospects for world peace. He senses gradual but persistent progress characterized by general welfare programs appearing where governmental apathy previously reigned, by the emergence of balancing interest groups to offset original control by private monopolies in the natural resource industries, and by the development of some resemblance of democratic processes where once dictatorship thrived. He is apprehensive lest our nation fail to keep up with this progress—or more importantly—fail to provide much needed leadership in this evolutionary struggle for survival.

How can this leadership be achieved? Through freedomism. "This goal [the ultimate goal of a free society] is freedomism in action in everything. For each individual it includes freedom of mind, liberty of choice, and equality of opportunity." Here the author shows a healthy respect for attention to concepts and their careful formulation.

The first of the triad, freedom of mind, implies the absence of any authority determining one's values. Once values are *created, then* liberty is the unmolested opportunity to achieve those values by choosing among all available (presumably all available to anyone else in that society) alternatives in every aspect of living—except as it conflicts with an available alternative to others. Finally, freedomism is reached with equality of opportunity in which *every* individual has the *same* liberty in achieving his values.

As the author attempts to scrutinize America today for its freedomism "temperature" via a reading on its institutions of Government, Religion, Education, Economics, Press, Family, Health, Leisure, Recreation, and

Art, tones of optimism and then pessimism alternately characterize the analysis. This part of the investigation is most interesting and informative. For example, he finds the very source of information to be endangered by the intricate network of newspaper chains and advertising agencies—with the case cited of one western editor facing withdrawal of his national advertising patronage unless he halted his editorial support of a government program. The author is dedicated throughout to the "middle way," the cooperative, the labor union, and TVA while denouncing unrelentlessly the private utility empire and McCarthyism.

However, the author feels his program does have hope. "It [Freedomism] is our most potent method and program to attract all people to our Western approach for a desirable national and world order."

The author should be commended particularly for penning a forthright, convincing plea for independent thinking, informed decision making, and nonconformity. Social scientists, along with laymen, need such recharging frequently for use both as a citizen and as a fledgling scientist.

This reviewer feels that the treatise could have been strengthened on two basic counts. First, the principles of freedomism seemed to be offered one moment as operational concepts and in the next as ideals or goals for human conduct. True, the frontiers of science and knowledge generally are pushed back as new, improved systems of functional concepts, along with the factual relationships facilitated with these systems are developed. Such insight into the relationships between various social organizations and resultant patterns of living is the heart of this study. However, when such systems of concepts are pronounced as generalized goals, the very creative aspect of educated thought becomes stifled.

Must the world always be hounded with ultimate ideals—be they the divinity of the monarchy, the naturalism of the castes, the maximum welfare of the competitive matrix, or even the goodness of freedomism—each pressed by its devotees as the panacea for each man's *particular* problems? "Freedom of mind, liberty of choice, and equality of opportunity are, it appears, good in and of themselves as satisfying activities." How could one possibly prove such a normative proposition? If one really believes that human beings are the best custodians of their own values, why not provide concepts, knowledge of experiences, and an ever-expanding body of relationships between phenomena—then be content to let man and his society choose his particular aim within his grasp? To do otherwise appears to this reviewer to pervert the generalized nature of concepts for personal purposes of indoctrination and deadens the creative nerve of the listener in the process.

Secondly, the notions of *rights* and *power* might have been strengthened. Instead of rights as inherent to man, John R. Commons saw them created in a *duty-right relationship*. Economic power crept in repeatedly

as a force on the side of subjugation, retrenchment, or governmental infringement, while J. K. Galbraith broadened it into a meaningful concept of *countervailing power*. In fact, the author might well consider the usefulness of conceptualizing as *economic power* the entire array of inherent, acquired, and socially permissive attributes of the individual capacity to achieve his economic designs. As such, it can be expanded, restricted, studied, analyzed, it can serve for good or bad—in other words, be used in all the areas of social science investigation.

As one reads this book, and it will be well worth the time, a comment by the author of the preface seems relevant. "As a limitation, this book has entwined in it only one man's view of things that make life worth while and challenging." Over-enthusiasm in some of his beliefs, so vital to the investigator, however, need not discredit all an author's findings.

ROBERT G. SPITZE

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Man's Role in Changing the Face of the Earth. Edited by William L. Thomas, Jr., with the collaboration of Carl O. Sauer, Marston Bates, and Lewis Mumford. Chicago: The University of Chicago Press, 1956. Pp. xxxviii, 1193. $12.50.

The Wenner-Gren Foundation is concerned with the advancement of anthropology as the study of man. Through the international symposium on "Man's Role in Changing the Face of the Earth" held in June 1955, the Foundation hoped to keep abreast of what man has done and is doing to change his physical-biological environment on the earth.

The symposium explored the question, "What has been, and is, happening to the earth's surface as a result of man's having been on it for a long time, increasing in numbers and skills unevenly, at different places and times?" Scholars from many branches of learning were brought together in an attempt to provide a broader understanding of what has happened and is happening to the earth under man's impress. The concepts of man and nature are broadened to consider man as part of the environment. Within the past century the idea has developed that change is continuous and includes man himself.

The introductory article points out how the airplane has enabled us to appreciate the infinite variety of environmental patterns and to appreciate their dynamic relationships. The article is well illustrated with aerial photographs. A new discipline, "social ecology," is suggested to include those branches of social and natural sciences that have a bearing on the role of man in re-forming his habitat. It is pointed out that there is a need for the study of human communities both as a whole and in their total relationship to their physical and social environments.

The book is divided into three parts. *Retrospect* contains 17 articles

tracing cultural development "through the corridors of time" and the changes man has brought about on earth. Man's widespread use of fire in modifying his environment, the extent of hydraulic civilizations dependent on large-scale management of water, the clearing of woodlands, and the change from subsistence economics to industrial and modern urbanization are covered in this part.

Process covers the methods and means by which man has altered the face of the earth. The 26 articles in this part of the book deal with man's effect on the seas and waters, modification of climate, slope and soil changes through human use, modifications of biotic communities, disposal of man's wastes, and urban-industrial demands upon the land. It is pointed out that "changes induced by man, whether by sheer destruction or indirectly by accelerating natural processes, are probably more important to him than the so-called natural changes for which he is not responsible." Erosion, pollution, and contamination are among the more serious problems arising from changes induced by man. Urban and industrial developments require large amounts of land and in addition, large numbers of urban people return to the countryside for their recreation.

Prospect turns to the future and examines population growth, limits of raw material and energy use, and some possible long-run consequences of technology. The seven articles in this section deal with the problems of a limited physical world, an expanding population, and whether technology can solve the problem of maintaining a high level of living.

This book should be of value to the economist concerned with a broad view of the problems of resource use. As a background for consideration of resource policy questions, it has great value. The Wenner-Gren Foundation has performed a valuable service in making available the papers and the summary of discussion from the symposium.

HARRY A. STEELE

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Agriculture, History of the Second World War, Keith A. H. Murray. London: Her Majesty's Stationery Office and Longmans, Green and Co., 1955. Pp. xii, 422. $5.60.

Economic historians are well acquainted with the United Kingdom Series on the *History of the Second World War.* The 25 studies in the series provide comprehensive coverage of economic developments in the United Kingdom from 1939 to 1946. The authors were given free access to official documents of the government. But they and the editor of the series, Sir Keith Hancock, are alone responsible for the statements and views expressed.

Sir Keith Murray, author of the volume on agriculture, is a well-known

agricultural economist and educational leader in the United Kingdom. He spent many years at Oxford University, first on the staff of the Agricultural Economics Research Institute and later as Director of Lincoln College.

The book is in four parts. The first reviews agricultural developments during World War I and the interwar period and tells about plans made for agriculture in case of war. The second and third are chronological accounts of food production achievements, import programs, domestic production programs, and measures taken to implement production programs during each of the six years from 1939-40 to 1945-46. The fourth is general description and appraisal of production policies and achievements, changes in the structure and technique of farming, methods adopted for control and direction of production, and formulation and execution of policy.

The author concludes that "this history should be, without question, a 'success story,' successful far beyond the calculations and estimates of prewar planners. Their maximum demands from British agriculture were based on assumptions of a three years' war and the making good of a total reduction in imports of 25 percent. In fact, these demands had to be increased to meet an eventual reduction of food imports of 55 percent and a war that taxed agricultural resources for six years. Two salient points have emerged; the food necessary to maintain the civil population in health and vigor was forthcoming for six years and the organization designed to produce this worked successfully."

What were the dimensions of the farm production effort and how was it done? Perhaps most outstanding was the plough-up campaign under which the acreage in crops and temporary grass was expanded by 50 percent and that in permanent grass was reduced by 40 percent. The increased emphasis put on production and utilization of crops for human food caused the net output of calories from British agriculture to nearly double from 1938-39 to 1943-44. More feed crops were produced, although not enough to offset a decline in feed imports from 8.7 million tons in prewar to 1.3 million tons in 1943-44. Output of meat and eggs decreased greatly but that of milk decreased very little. The almost 50 percent larger farm sales of milk for human consumption did much to maintain and improve human nutrition. Net output of British agriculture after taking into account reductions in imported feed, livestock, and seed was 25 percent higher in 1943-44 and 20 percent higher in 1944-45 than prewar. Use of manpower, mechanical power, and fertilizer on farms increased. Still, it is reported that economic productivity of agriculture was improved.

Financial incentives and means for expanding farm production were provided by rising prices and incomes. Agricultural prices doubled.

Farmers' costs went up too, but net farm income increased three times. Grants and subsidies were paid to farmers for ploughing up permanent pastures, improving drainage, applying lime, and other practices. Special acreage payments were made for potatoes, wheat, rye, and flax. Rationing of feed, fertilizer, fuel, and machinery helped to get resources used where their economic productivity in terms of contributing to food needs would be greatest. The wartime effort entailed much governmental regulation of farm production and resource use. Major credit for the success of public administration in agriculture is given to the county agricultural executive committees, who carried out effectively the many powers delegated to them by the Minister of Agriculture and Fisheries.

The achievements of British agriculture during World War II are impressive, and one feels bound to agree with the authors' conclusions.

Sir Murray is to be complimented for preparing this authoritative and comprehensive economic history on British agriculture during World War II. It recalls the parallel study on United States agriculture, *The Farmer in the Second World War* by Walter W. Wilcox, published in 1947 by the Iowa State College Press. But coming as it does nearly a decade after the end of World War II, a chapter or two on postwar developments in British agriculture would have been interesting to this reviewer.

RAYMOND P. CHRISTENSEN

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The Combined Food Board, Eric Roll. Stanford: Stanford University Press, 1956, Pp. xiii, 385. $7.50.

This excellent book could have been written by no one except Eric Roll. An able social scientist, who joined the staff of the British Food Mission in Washington at the beginning of the war and was closely associated with the Combined Food Board from the time it came into existence until its work was finished, he writes with insight and objectivity about an organization and about events in which he himself played an important part.

This book is much more than a well-presented record of the Board's activities. Its greatest value lies in Roll's keen analysis of the difficulties to be overcome in making any international board of this sort work successfully and of the special difficulties involved for an Anglo-American Board dealing with problems of food allocation during these particular years.

Beginning with the procurement difficulties faced by Britain in the period before Pearl Harbor, Roll sketches in the early steps in joint planning which led to the establishment of the Board in 1942. Chapters 3

and 4 give the reader a clear description of "the new machine" and the way it worked, together with an appraisal of its usefulness and a penetrating discussion of the defects that prevented it from being more useful. Following this is a chapter of especial interest and lasting significance on allocation theory—the search for basic principles to be applied in the sharing of food supplies internationally and the development of the factual information needed as a basis for applying them. With this background established, the author goes on to discuss allocation in practice, the relations of the Board with Russia, its relations with liberated countries, and the food crisis of 1945. The final chapters of the book explain and evaluate the organizational changes made in 1944-45, the ways in which the Board dealt with the complex problems of transition from war to peace, and contributions made by its work to the postwar program of the International Emergency Food Council.

Roll makes it perfectly clear that the British had a special interest in the effective operation of the Board because this would facilitate their food procurement in the United States, but stresses the fact that this was not their sole objective. They conceived of the Board as a mechanism through which the top authorities in control of the food supplies of the two countries would sit together as joint planners to insure the best use of this important resource in their common war effort. Interest on the American side was not so great, and many of the weaknesses in the Board's operation were due to organizational defects in the food management machinery of the U. S. government.

Early in the book he points out that, although food was such a vital matter to the British, the people of the United States had never had any reason to concern themselves about food shortages. American supplies relative to American needs were sufficiently abundant that, in the absence of external requirements, the need to introduce a strict governmental food management program would not have been nearly so urgent. Add to this our strong aversion to controls (not stressed by Roll) and many of the organizational difficulties of the Combined Food Board can be readily understood.

The establishment of war agencies in any government is likely to meet with resistance from the permanent agencies that have been carrying on peacetime functions in related fields. No established agency in Washington was more jealous of its authority than the Department of Agriculture. None was in a better position to protect its prerogatives. During the early years of the war, food management responsibilities remained largely in the hands of the Secretary of Agriculture. But even this did not reconcile the established agencies within the Department to the intrusion of the new staffs needed during the emergency. Actually it was not until after the Combined Food Board had been in existence for

nearly a year and a half that unification was achieved on the American
side of the organization. For a considerable part of this period the Sec-
retary of Agriculture had a staff in the Food Distribution Administra-
tion working for him on allocation problems in his role as the trustee
for American food supplies and a different staff in the Office of Foreign
Agricultural Relations working for him in his role as a member of the
Combined Food Board. Later the situation became even more baffling
for all concerned when the allocation authority was vested in the hands
of a War Food Administrator, while the U. S. representative on the
Combined Food Board continued to be the Secretary of Agriculture.

The achievements to be credited to an agency like the Combined
Food Board, without any sizable staff of its own and without any author-
ity in its own hands, are always difficult to identify, and the difficulties
in the present case are even greater than usual because of the untidiness
of the American side of the organization. It is true that the staffs "at
lower levels" in the Department of Agriculture and in the Ministry of
Food worked effectively together on many matters of common interest.
It is true that the American members of these teams very often belonged
to agencies directed by the man who was the U. S. representative on
the Board. But the extent to which the results of this cooperation should
be attributed to the Board itself is a question on which opinions are
likely to differ.

The only three tables reproduced in the appendix of Roll's book re-
sulted from a project known as the Joint U. S.-U. K.-Canadian Food
Consumtion Levels Inquiry. In explaining his selection of these tables,
he says: "They are of lasting historical value; and it is not altogether
vain to think that the statistics they contain reflect to some extent the
effect of the Board's own activities."

Actually, the 1943 study, in which the pioneering work was done, was
carried out in circumstances that linked it with the American members
of the Board's staff only in a negative way. The British had already
supplied the American executive officer with almost all the detailed
facts about consumption in the United Kingdom that were later pub-
lished in the consumption levels report, but the information had been
treated so confidentially by him that not even the Secretary of Agricul-
ture himself knew of its existence. Not having access to these data, the
Requirements and Allocations staff of the Food Distribution Administra-
tion made estimates of British consumption from the indirect evidence
available to them.

The figures were subsequently proved to be substantially correct, but
various agencies in the U. S. government, including the Office of Foreign
Agricultural Relations, promptly protested that the Requirements and
Allocations staff, in making these estimates, had gone far beyond the

limits of its authority and its competence. The British Food Mission, on the other hand, immediately supplied this staff with copies of the tables previously transmitted ineffectually through official CFB channels and suggested the development of thoroughly comparable sets of figures through a joint study.

In these circumstances, it was natural that United States participation in the Consumption Levels Inquiry would be through the Food Distribution Administration rather than through the American section of the Board's secretariat. Similarly, the British members of the team came from the Ministry of Food, not from the Mission in Washington, and the proposal that the Board should designate a chairman for the group was unanimously rejected by those who were to do the work on the job. It was only when the basic 1943 study was ready to go to press that the introduction was rewritten in such a way as to imply that the job had been done under the auspices of the Board.

The Consumption Levels Inquiry was a good example of wartime cooperation between the governments of the three countries concerned, but its success, instead of being taken as evidence of the usefulness of the Combined Food Board, could be interpreted equally well as evidence of what can be achieved by sheer good will in spite of whatever faults may be present in the formal institutional arrangements through which it has to express itself. To certain other joint projects, the Board undoubtedly contributed more than it did to this one, but, on the basis of Roll's analysis, together with what is known from other sources, the judgment of history may well be that the Combined Food Board was more important as a symbol of the desire to cooperate than as a mechanism for implementing it.

JOHN M. CASSELS

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Public Control of Economic Enterprise, Harold Koontz and Richard W. Gable, New York: McGraw-Hill Book Company, Inc., 1956. pp. xii, 851, $7.00.

The authors of this volume state in the preface that it "is designed to describe and analyze the field of public control of economic enterprise in the United States. The word 'control' has been interpreted to apply, in addition to specific regulation of business, to the intervention of government into economic affairs through aids and ownership and through broader fiscal and monetary controls designed to influence the entire economy." This is a large task. The authors set about it by dividing the book into eight parts.

Part One introduces the problem of economic control and the constitutional and administrative framework affecting its development. Part

Two is concerned with transportation; Three with public utilities; Four with the maintenance of competition; Five with protection of the investor; Six with labor; Seven with public promotion (aid) and ownership of economic enterprise; and Eight with broad public control of the entire economy.

This volume suffers from its extensive breadth of coverage and a consequent lack of analytical depth in many parts. Its broad coverage has led the authors to devote a relatively large amount of effort and space to descriptive and background material and correspondingly less to analysis of past, present, and future public policy as regards the control of economic enterprise. For reasons of space, and the presumed interests of readers of this *Journal*, specific comment will be confined to parts One, Four, and Seven (see above)—the latter including a treatment of public aids to agriculture.

The authors point out in Chapter 1 that when "the code of *laissez faire* or the rules of modified free enterprise" do not protect the public from "political and social problems" they naturally turn to government for protection. They further state that the "continual emergencies of the past twenty years have furnished a setting in which the freedom of business decision making has been increasingly circumscribed by government action." This point of view, reflected at many other points in the book, appears to gloss over (until the last chapter) the primary cause for governmental regulation of business—its antisocial operation in the absence of such regulation.

Chapter 2 contains a good brief summary of the powers of economic control exercised by, and limitations imposed upon, federal and state governments under the constitution and its interpretation by the courts. Chapter 3 presents a descriptive review of the techniques (those instrumentalities through which control is exercised—administrative regulation) and types (objects or purposes of control—control of rates or service) of economic control.

The confusion and conflicts in public policy with respect to control of economic enterprise are reflected in the confusing and conflicting ideas and conclusions presented by the authors in the chapters dealing with the maintenance of competition and with agricultural programs and policies. The authors, who have drawn on a wealth of previous research and writing in each area discussed, appear to have presented the conclusions from many of these studies—which are frequently in conflict with one another—without an attempt to reconcile these conflicts. For example, in one place the authors give first recognition to the critical importance of price competition—not generally found in concentrated industries—in promoting general economic welfare. At other places they contend that nonprice competition may actually be as strong and as

important to economic welfare as any system of price competition.

The recognition and reconciliation in a broad sense of many of these conflicts is presented in the final chapter. A better understanding of the over-all problem would have been left with the reader had more of this reconciliation come in the main body of the text.

The chapters on transportation and public utilities control and regulation reflect a thorough comprehension of programs and policies in these areas. However, there is an apparent lack of understanding on the part of the authors regarding the intent and content of most recent agricultural programs. Implied throughout the chapter on aids to agriculture is the notion that the bulk of our agricultural programs are directed toward the low-income farmer, while in fact most of our agricultural programs benefit primarily the farmers with higher income.

From the standpoint of public policy the authors would prefer to move in the direction of further governmental price and service regulation of business to protect consumers from monopolistic situations rather than a vigorous enforcement of antitrust legislation.

Setting aside these criticisms the authors have provided a useful text for a survey of the field of "public control of economic enterprise." A more advanced treatment would require substantial supplementation by reference to the literature which they have well documented.

FLETCHER E. RIGGS

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Farm Management Manual, Trimble R. Hedges and Gordon R. Sitton, Palo Alto, Calif.: The National Press 1956. Pp. iv, 133. $3.00.

The Farm Management Manual is a paper-covered spiral notebook designed for the laboratory phase of the first course in farm management for upper division agriculture students or of the second course for Freshman and Sophomore students. It is the result of the authors' experience in teaching a Junior-year farm management course at the University of California at Davis. The manual is divided into fourteen exercises or problems on various aspects of the farm business. Each of these fourteen sections consists of about three pages of manuscript indicating the nature of the exercise and a discussion of principles; two pages designating the objectives of the exercise, references and the procedures to be used; and from one to five pages of budgeting forms to be completed. In addition, twenty-five pages of reference tables are provided. These reference tables—in fact the whole manual—have a rather distinct Western flavor, but this alone does not necessarily restrict its usefulness to that area. The manual is easily read and has an attractive cover. It represents a courageous attempt on the part of the authors to bring to the farm management laboratory section a high degree of organization and, at the

same time to relieve the laboratory instructor of the responsibility of preparing a great number of budgeting forms to be passed out to the class.

The organization of the manual follows the traditional and "natural" pattern: (1) inventorying the farm resources, (2) determining the most profitable cropping system, (3) calculating the power and equipment necessary to care for the crops, (4) analyzing feed supplies and planning the livestock system, (5) calculating the labor required to care for the crops and livestock, (6) summarizing the farm business, and (7) analyzing the earnings and efficiency. However, the organization of a book or manual is perhaps best evaluated not on the basis of whether it is traditional or "natural" but on how well it facilitates the students learning what the teacher wants them to learn.

Early in the manuscript the authors indicate the primary emphasis will be placed on teaching the principles and procedures of decision making. Since problem formulation and reformulation is an integral part of decision making, one might expect that the procedure to be followed would be that of taking an existing farm business, analyzing that farm business for the purpose of discovering possible opportunities for improvements either in the combination of enterprises or in the conduct of existing enterprises, and developing and comparing alternative lines of action in a series of more or less partial budgets. However, in this manual, analysis of the farm business is left to the last so that its assistance in helping the student learn the procedures of decision making is minimized. His attention is distracted from the problems of the farm organization and directed toward the completion of what might appear to the student as an almost endless series of tables.

One might also expect that one of the objectives of a beginning course in farm management would be to emphasize the inter-relationships between the various parts and the whole of the farm business, but this manual seems to emphasize a one-way relationship, from crop toward livestock. For example, the authors state (p. 57), "Most farmers and ranchers regard land as *the* (my italics, not theirs) limiting resource which determines their production and profit. . . . The skilled manager first plans his most profitable cropping system then considers whether or not livestock will add to his profit (the underlining is theirs, not mine). The best way for the manager to view the question, 'Will livestock be profitable for me?' is as a secondary issue, answered after he decides on a cropping system. . . . He selects crops because they offer him his greatest profit opportunity, not because they fit into a livestock program." With this basic philosophy and because the manual was written primarily for use in a crop-farming area, it is not surprising that the authors treated

livestock as a secondary enterprise and chose to devote almost twice as many pages to planning the crop enterprises as they did to planning the livestock enterprises.

It is, of course, a difficult, if not impossible task, to prepare a farm management laboratory manual that will be applicable to the many diverse agriculture areas in this country. No doubt many teachers in largely cash-crop farming areas will find this to be a useful manual. However, teachers in most Midwestern, and Eastern universities will find it difficult to justify asking their students to pay $3.00 for the manual. Nevertheless, teachers in these areas may be interested in it as an example of the high degree of organization to which the laboratory section of the first farm management course can be brought.

LEE M. DAY

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Economic Analysis, Edmund Whittaker, New York: John Wiley & Sons, Inc., 1956, pp. xiii, 460. $6.50.

This book is designed "to serve as a text for students taking the courses on economic analysis and economic theory which, in American colleges and universities, commonly are offered to undergraduates after they have had an introductory course in general economics."[*] The book, as far as rigor is concerned, is about on par with Boulding's book of the same title.[**] It is not, however, as original as Boulding's *Economic Analysis* was at the time it was published. But this is a textbook and it is not intended as an original contribution. Those instructors who believe in "spoon feeding" their undergraduates probably will not be interested; those who are looking for an exhaustive treatment of economics with capable application of the analytical tools to current problems will want to examine the book closely.

Whittaker's book has two main parts. Part I is entitled "Principles and Procedures" while Part II is called "Applications to the Present Day Economy." The reviewer believes that this labeling of the two parts is not entirely accurate. There is material in Part I that is neither principle nor procedure, while many principles are both developed and applied in Part II. In Chapter I the nomenclature of economics is served up in a neat and complete fashion. Economics is then discussed as an art and as a science. There is also a chapter on "Interpretation of Experience" and one on "Planning" in Part I. Part II starts with the general equilibrium system of Walras, then moves to choices of the individual,

[*] Preface, p. vii.
[**] Kenneth Boulding, *Economic Analysis,* Harper Brothers, 1948, rev. ed.

followed by a treatment of consumption, production and price. The book is concluded by chapters on employment, income distribution and economic progress.

One is impressed in reading the book by the author's grasp of the literature of economics. This is to be expected, of course, of one of Professor Whittaker's reputation. The contributions of the various economists of note is woven together in a volume that has both breadth and depth. Not only is the theory presented but application is made. Illustrations and examples abound.

My other comments are of a minor nature. Those economists who have a particular area of economics where they have a special interest may be disappointed in the treatment it receives. For example, the whole field of risk and uncertainty is inadequately developed. The work of Knight and Hart is not mentioned nor have their contributions been used. The book would have been more complete if a chapter on entrepreneurship had been included. Such a chapter would have complemented both the treatment of production as well as the chapter on economic progress. While Chapter 3, "Economics as an Art," may be interesting to some, it does not appear as logically developed as the remainder of the book. Tangents have been pursued that seem to have little relation to the main topic. On the other hand, Chapter 4, "Interpretation of Experience," is excellent. Teachers of methodology may find this chapter to be of value as a reading assignment. Although many definitions are given in Chapter 1, elasticity concepts are used in Chapter 2 without definition. In the chapter on production, an agricultural example of multivariable analysis is given. Agricultural economists may be somewhat puzzled as to how this example relates to the theory that previously had been developed or the practical meaning of the results. At the end of each chapter exercises have been included. The exercises appear much more elementary than the text of the book.

On the whole, it is evident the book constitutes worthwhile addition to the texts written for a similar purpose. It is well balanced between induction and deduction, as well as subject matter coverage. Those teaching intermediate economics will want it on their book shelf if they do not adopt it as a text.

EMERY N. CASTLE

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The Effects of The Price Support Program on The Dry Bean Industry in Michigan, Dale E. Hathaway. East Lansing: Michigan State College, Agricultural Experiment Station, Technical Bulletin 250, 1955, pp. 71.

It is perhaps trite to say that continuous review of government farm programs is a necessity in the interest of both farmers' and the public.

In spite of the frequent calls for and obvious need of, serious, objective, unbiased analyses of government programs are far from being many in number. Professor Hathaway's neat little analysis fulfills this need in part and makes other significant contributions of a more fundamental nature as well.

Hathaway's line of approach is that statistical determination of the economic and physical relationships pertaining to the dry bean industry are a prerequisite to any objective and quantitative evaluation of the support program for dry beans. Thus, a substantial part of the bulletin is given over to discussing the econometric models presented and the logic behind them. Three equations—that together describe the major relationships—are presented: (1) an acreage-planted equation, (2) a yield equation, and (3) a price equation. The coefficients obtained for the acreage-planted and price equations are about as would be expected, but the yield equation contains some interesting findings. One such finding (p. 35) ". . . is that much of the variation in yields, commonly assumed to be due to weather, has also been a result of changes in acreage." This part of the bulletin should prove of considerable interest to applied commodity analysts and econometricians as well—for Hathaway's kit-bag of econometric techniques is full to overflowing.

Sufficient effort and space are devoted to background material and historical summaries of the various government programs for this commodity to place the statistical analyses and evaluation of the programs in proper perspective. Hathaway divides the programs chronologically as follows: Prewar, Wartime, and Postwar. Objectives—like fashions—change with the times and Hathaway properly spells them out for each period.

The sections devoted to evaluation of the support program should prove very useful to program analysts and individuals interested in a factual analysis of one of the many government programs. But those blindly seeking brickbats to throw at "high, rigid, price-support programs" will do well to avoid this bulletin. Despite the obvious impossibility of precisely measuring all the benefits and limitations of the program, Hathaway comes near to such a goal. His major conclusions are as follows:

(1) Income to Michigan producers was considerably higher than it would have been in the absence of such government programs.
(2) The programs resulted in considerably more stability in production, price, and income, than would have occurred in their absence.
(3) A "flexible price program" would have resulted in somewhat lower income and would not have avoided substantial government purchases in some years.
(4) A "direct payment program" would have resulted in the highest

income to producers but the cost to government would be "...more than one-half greater than the acquisition costs under the loan and storage program."

Many more interesting conclusions are also presented, but space limitations prevent their listing here. High supports, for example, did not stimulate increased plantings or measurably affect yields. After reading this bulletin—and particularly those sections devoted to analysis of the programs—this reviewer is of the opinion that it could well serve as a primer for program analysts.

In a review in the August issue of this *Journal*, Galbraith lists four rules to avoid if agricultural economists are to play an effective role in agricultural policy and avoid being reduced "to the role of neglected scolds." The rules (p. 880):

(1) Always identify conservatism with wisdom.
(2) Accept the uninhibited price system as a social and scientific norm.
(3) Avoid controversy at all costs.
(4) If the foregoing rules do not apply advocate more research.

If avoiding these rules is a criterion of effective analysis, Hathaway has passed this test. But perhaps the best indication of the general excellence of this report is the fact that this was judged to be the outstanding published research in the field of agricultural policy during 1955 by men under 40 and Hathaway received one of the three AFEA awards attesting to this.

While the bulletin contains an appendix that describes the statistical procedures used, it is unfortunate that reference tables containing data used in the analysis were omitted. In an analysis such as this alternative formulations of the structural relationships believed to exist are always possible. Inclusion of the data would have enabled other research workers not only to check Hathaway's results but also to test their imagination against his in the manipulation and use of the data.

In summary, this bulletin is recommended reading for agricultural economists, whether engaged in research, program administration, or teaching courses in agricultural policy.

A popularized version entitled *How Price Supports Affected the Dry Bean Industry in Michigan* is also available.

Rutgers University   KENNETH W. MEINKEN

NEWS NOTES

A. E. ANDERSON, Statistician in Charge of the Lincoln, Nebraska office retired from this office on December 31, 1956. He served the government for 42 years and 6 months.

H. O. ANDERSON, member of the staff of the Farm Economics Research Division, ARS, stationed in Wisconsin, died on December 31.

C. B. BAKER joined the staff of the Department of Agricultural Economics, University of Illinois, on January 1, 1957.

GEORGE L. BAKER, JR. has joined the staff at Purdue University as marketing extension specialist. He is working in the retail marketing education program.

RANDOLPH BARKER, formerly a member of the staff at Oregon State College, joined the staff of the Farm Economics Research Division, ARS, in February. He is stationed at Ames.

ROY D. BASS, of the Agricultural Estimates Division transferred from Little Rock, Arkansas, to Montgomery, Alabama, in the Office of the Statistician in Charge on August 12, 1956.

WARD W. BAUDER of the Farm Population and Rural Life Branch of the Agricultural Economics Division, AMS, is working on the Farm Population Studies in conjunction with the Iowa State College at Ames. He is a social science analyst and joined this organization in September 1956.

ROBERT I. BECKLER, business economist formerly with Colgate University, joined the staff of Market Organization and Costs Branch of the Marketing Research Division, AMS on September 18, 1956.

RALPH A. BENTON, joined the staff of Southern Illinois University as Associate Professor in June 1956 to do work in farm management. He was formerly an associate professor at Illinois State Normal.

ALVIN L. BERTRAND, supervisory social scientist, joined the Agricultural Economics Division on February 4, 1957 as head of the Levels of Living Section, Farm Population and Rural Life Branch, AMS.

KENNETH D. BLOOD, Statistician in Charge of the Agricultural Estimates Division, AMS, Oklahoma City Office in Oklahoma retired on April 30, 1957 with 37 years of government service. He was replaced by Donald D. Pittman of Denver, Colorado on May 1, 1957.

MARTIN A. BLUM who has completed his class work for a Ph.D. degree at Cornell University has joined the staff of Farmer Cooperative Service, U. S. Department of Agriculture. He will conduct research on the marketing problems of fruit and vegetable cooperatives.

A. DEWEY BOND has been appointed Washington representative of the American Meat Institute, and was transferred recently from Chicago to Washington, D.C.

JOHN M. BREWSTER, agricultural economist, left the Market Organization and

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Costs Branch of the Marketing Research Division, AMS on November 16, 1956 and joined the research staff of the Agricultural Research Service.

HENRY G. BROWN transferred to the Program Analysis Branch, Grain Division of the Commodity Stabilization Service on August 26, 1956. He formerly was in the Food Grain and Legume Section of the Field Crop Statistics Branch.

REX G. BUTLER of the Agricultural Estimates Division transferred from the Prices Paid Section of the Agricultural Price Statistics Branch to the Livestock Section of Livestock and Poultry Statistics Branch on March 10, 1957.

WENDELL C. CALHOUN, formerly of the Western Agricultural Economics Research Council, will spend a few years in Hawaii in the newly opened office in Hawaii. He started his new position on April 1, 1957 and will work on cooperative research in dairy and probably later on with other commodities. He will be stationed at the University of Hawaii in Honolulu.

PROCTOR CAMPBELL transferred from Foreign Agricultural Service to the Market Development Branch, Marketing Research Division, AMS during the past month.

ROBERT P. CHRISTENSON of the Agricultural Estimates Division of Lincoln, Nebraska transferred to the West LaFayette, Indiana office on August 26, 1956.

HUGH L. COOK, Associate Professor of Agricultural Economics, University of Wisconsin is on leave of absence for one year during which time he will serve as Agricultural Economics Advisor at the U. S. Operations Mission, I.C.A. Manila, Philippines. His job will be to advise with the Chief, Agricultural Economics Division, Philippine Department of Agriculture and Natural Resources.

FRED T. COOKE joined the staff of the Farm Economics Research Division, ARS, in January, stationed at Stoneville, Mississippi. Mr. Cooke received his B.S. in 1955 and his M.S. in 1957 from Texas A & M.

MARTIN R. COOPER retired on January 31 from the Farm Economics Research Division, Agricultural Research Service, after more than 44 years in the USDA. He joined the staff of the Office of Farm Management, then in the Bureau of Plant Industry, in 1912. Mr. Cooper was one of the early professional workers in farm management who led the way in helping to develop and organize a strong national program of research and service in agricultural economics. Since 1954, he has been assistant head of the Farming Efficiency Section of the Farm Economics Research Division, ARS. Mr. Cooper received the Department's Superior Service Award in 1947.

W. C. DACHTLER replaced J. Roy Allgyer who retired as Executive Secretary to the Research Advisory Committees on Grain, Feed and Forage, Refrigerated and Frozen Products, and Rice. Mr. Dachtler was head of the Grains and Feeds Section of the Market Organization and Costs Branch of the Marketing Research Division, AMS.

PIERRE DE SCHLIPPE, Belgium, was employed as FAO Consultant on Shifting Cultivation. Mr. de Schlippe was at FAO Headquarters in December and February.

H. M. DIXON, formerly Director, Division of Agricultural Economics Programs, Federal Extension Service, U. S. Department of Agriculture, retired from service on December 17, 1956. Mr. Dixon, a native Ohioan, began his agricultural career at the Ohio Agricultural Experiment Station. He joined the office of farm management of the Department of Agriculture in 1911, and subsequent to passage of the Smith-Lever Act became associated with the Cooperative Extension Service. The development of agricultural economics extension work, progressively encompassing wider fields of social science interests, including farm management, marketing, rural sociology, and public affairs, has continued since the formal organization of the extension economics program in 1930. Mr. Dixon was Vice President of the American Farm Economic Association in 1936, and from 1939 to 1941 served as chairman of the Association committee on farm management terminology. From May 1943 to April 1946 he was Assistant Deputy Director of the Extension Service Emergency Farm Labor Program.

JAMES R. DONALD, agricultural economist, joined the Agricultural Marketing Service on February 18, 1957, in the Price and Trade Section, Statistical and Historical Research Branch of the Agricultural Economics Division.

GEORGE C. EDLER, Head of the Seed Section, Field Crop Statistics Branch, in Washington, D.C. Office retired on October 31, 1956 with more than 40 years of government service.

HAROLD V. EDWARDS, of the Agricultural Estimates Division transferred from the Columbia, Missouri office to the Poultry Section of the Livestock and Poultry Statistics Branch in Washington, D.C. on January 27, 1957.

ROBERT V. ENOCHIAN, Agricultural Economist, transferred from the Market Organization and Costs Branch to the Market Development Branch, Marketing Research Division, AMS, in February 1957.

JAMES ESMAY joined the staff of the Farm Economics Research Division, ARS, in January, reporting for duty at Bozeman.

CECIL W. ESTES, of the Agricultural Estimates Division of the Livestock Section, Livestock and Poultry Statistics Branch in Washington, D.C. transferred to the Sacramento, California Office on February 10, 1957.

GEORGE M. FERRELL of the Agricultural Estimates Division transferred from the Austin, Texas Office to the Prices Paid Section of the Agricultural Price Statistics Branch in Washington, D.C. on March 10, 1957.

WILLIAM J. FLUKE of the Agricultural Estimates Division transferred from the Portland, Oregon Office to the Feed Grain and Hay Crops Section of the Field Crops Statistics Branch in Washington, D.C. on January 27, 1957.

FOOD RESEARCH INSTITUTE of Stanford University has received a grant of $96,000 from the Rockefeller Foundation to be used toward support of a program for interns in international economics. The program will provide two years of in-service training at the Institute, combined with studies

leading to the degree of Master of Arts. An initial group of five interns will begin their programs in September 1957.

W. J. FOREMAN has joined the staff of the Department of Agricultural Economics, University of Illinois, and has been assigned to the Allahabad Agricultural Institute, Allahabad, India.

JOHN FOSTER joined the staff of the University of Massachusetts as Assistant Professor of Farm Management on February 1.

EARL FRANKLIN joined the staff of the Farm Economics Research Division, ARS, in January, reporting for duty at Pullman, Washington. Mr. Franklin was with the Farm Management staff of the former Bureau of Agricultural Economics from 1939 to 1943 and from 1945 to 1946.

CHARLES E. FRENCH is on sabbatical leave from Purdue University and is at the University of California at Berkeley.

OAKLEY M. FROST has been promoted to Head of the Potato Section of the Fruit and Vegetable Statistics Branch. This is a new section, and Mr. Frost took over on October 21, 1956.

FRASIER T. GALLOWAY, of the Agricultural Estimates Division transferred from the Montgomery, Alabama Office to the Potato Section of the Fruit and Vegetable Statistics Branch in Washington, D.C. on February 24, 1957.

ALTHA R. GANS, Director of Research at the Federal Land Bank in Springfield, Massachusetts, was on leave to teach Farm Finance at Cornell University during the Spring Semester, 1957.

BRUCE M. GRAHAM, formerly head of the Farm Employment Section of Special Statistics Branch, became head of the Enumerative Surveys Section on February 12, 1957.

JAMES R. GRAY has completed the requirements for a Ph.D. at Oregon State College and returned to his position with PERB at New Mexico A & M College. His thesis was an economic analysis of drought practices used by eastern Oregon cattle ranchers in 1955. Gray will initiate a similar study in the New Mexico area.

W. SMITH GREIG resigned from the Market Organization and Costs Branch, AMS, in December, 1956 to become a member of the Agricultural Economics Department of Michigan State University.

ROBERT GREVE joined the field staff of the Farm Economics Research Division, ARS, in January, reporting for duty in Stillwater, Oklahoma. Mr. Greve attended Kansas State College, where he received his B.S. in 1953 and his M.S. in 1957.

HAROLD G. HALCROW has been named Head of the Department of Agricultural Economics, University of Illinois, effective September 1, 1957.

JAMES B. HASSLER, presently of the University of California will be on the Agricultural Economics staff of the University of Nebraska beginning July 1, 1957, as Associate Professor.

WARD W. HENDERSON, of the Agricultural Estimates Division, formerly Head of the Enumerative Surveys Section of the Special Statistics Branch in the Washington, D.C. Office transferred to Sacramento, California Office on January 13, 1957.

JOE D. HERMAN transferred from Austin, Texas office to the Statistical Clearance and Standards Office on August 12, 1956.

WILLIAM C. HINSON, of the Agricultural Estimates Division, transferred from the Vegetable Section of the Fruit and Vegetable Statistics Branch to the Special Crops Section in the Field Crop Statistics Branch in Washington, D.C. on October 21, 1956.

ROBERT C. HOBSON, of the Agricultural Estimates Division, formerly with the Special Crops Section of the Field Crops Statistics Branch in Washington, D.C., transferred to the Austin, Texas office on August 12, 1956.

J. A. HODGES of the Department of Agricultural Economics at Kansas State College will be on leave during the months of May and June to plan the program and serve as leader for a group of 21 persons from India who will be in the United States to study organization and activities of economic groups in American agriculture.

RUTH HODGSON, formerly on the staff of the Consumer-Distributor Marketing Branch, Federal Extension Service, resigned her position in April. She accepted a position with the Extension Marketing Information Program for Consumers in New York City.

IRVIN HOLMES, former head of the Vegetable Section of the Fruit and Vegetable Statistics Branch, became head of the Fruit and Nut Section of the same branch on November 18, 1956, replacing Mr. Schlotzhauer.

WILLIAM B. HUDSON, of the Agricultural Estimates Division, formerly with the Montgomery, Alabama office, transferred to the Food Grain and Legume Section of the Field Crop Statistics Branch in Washington, D.C. on August 12, 1956.

CLIVE JOHNSON, Agricultural Economist, transferred from the Census Bureau to the Market Development Branch of the Marketing Research Division, AMS, during the last month.

BRUCE W. KELLY, of the Agricultural Estimates Division, formerly at the Orlando, Florida office, transferred to the Research and Development Staff in Washington, D.C. on April 1, 1957.

E. SMITH KIMBALL, Head, Poultry Section, Livestock and Poultry Statistics Branch, of Agricultural Estimates Division, AMS, retired on December 31, 1956, with more than 30 years of service.

EUNICE M. KNAPP, analytical statistician, formerly with the Bureau of Labor Statistics transferred on October 1, 1956 to the Market Organization and Costs Branch, AMS.

L. JOHN KUTISH, formerly Agricultural Economist with the Federal Reserve Bank of Chicago, accepted a position as Associate Professor of Economics at Marquette University, Milwaukee, Wisconsin, beginning February 1, 1957.

THOMAS J. KUZELKA, Head of the Feed Grain and Hay Section of Field Crop Statistics Branch, replaced Mr. Edler as Head of the Seed Section, same branch.

DERRIS G. LAFFERTY, Agricultural Economist from the University of Arkansas, joined the Market Organization and Costs Branch on October 1, 1956.

JAMES F. LANKFORD transferred to the Latin American Branch, of the Foreign Agricultural Service on January 27, 1957. He was formerly in the Special Statistics Branch.

RICHARD H. LONG, Agricultural Economist, from Clemson Agricultural College, joined the staff of the Market Organization and Costs Branch on February 14, 1957. He will be working on grain.

ROBERT A. McGREGOR, formerly in the Seattle, Washington office of the Agricultural Estimates Division transferred to the Potato Section of the Fruit and Vegetable Statistics Branch of the Washington, D.C. office on November 4, 1956.

FRANK MEISSNER accepted a position as research analyst with the Market Research Department of Crown Zellerbach Corporation in San Francisco. He is also Instructor of Statistics at Golden Gate College.

JEROME W. MILLIMAN has accepted an appointment as Assistant Professor of Agricultural Economics at the University of California, Los Angeles. Dr. Milliman was formerly Assistant Professor of Economics at Florida State University.

C. CLYDE MITCHELL has resigned from the University of Nebraska, where he had been Chairman of the Department of Agricultural Economics during 1949-56, to join the staff of Technical Assistance Experts of the Food and Agriculture Organization of the United Nations. His present assignment is to assist the Ministry of Economics of Mexico on national and regional economic planning.

ROBERT H. MOATS, formerly head of the Prices Received Section, Agricultural Price Statistics Branch, became Chief of the Livestock and Poultry Branch on August 26, 1956, replacing Mr. Nordquist.

JOE E. MULLIN became Head of the Vegetable Section of the Fruit and Vegetable Statistics Branch on November 18, 1956. He replaced Irvin Holmes.

MARC NERLOVE, agricultural analytical statistician of the Price and Trade Section, Statistical and Historical Research Branch, AMS, will be on military leave for approximately two years.

S. DANIEL NEUMARK of the Food Research Institute of Stanford University has returned from a trip to Africa and Europe. He spent five months in Africa visiting the British territories in East Africa (Uganda, Kenya, and Tanganyika), the Central African Federation (the Rhodesias and Nyasaland), Portuguese East and West Africa, Nigeria, the Gold Coast, the Belgian Congo, and Ruanda Urundi. On his return trip, he participated in a seminar on organization organized by the Institute of Social Studies at the Hague. He also delivered a lecture on industrialization in Africa at the University of Utrecht.

MARVIN T. NORDBO joined the staff of the Department of Agricultural Economics at the North Dakota Agricultural College as Assistant Agricultural Economist on February 1, 1957. He will be working on a Cooperative Production Economics Study with the Tennessee Valley Authority on the Economics of Fertilizer Use.

ARNOLD V. NORDQUIST, Chief, Livestock & Poultry Branch, Washington, D.C. Office, replaces A. E. Anderson at Lincoln, Nebraska as Statistician in Charge.

ROBERT E. OLSON, Agricultural Economist, replaced Wendell C. Calhoun as Secretary to the Western Agricultural Economics Research Council, and was placed in charge of a considerable portion of the work of Market Organization and Costs Branch in that area on April 1, 1957.

FRANK ORAZEM, who was stationed at Ames, resigned from the staff of the Farm Economics Research Division, ARS, to join the staff of the Department of Agricultural Economics at Kansas State College, where he obtained his M.S.

HARRY T. OSHIMA, national income specialist with the Food Research Institute of Stanford University, has returned from a six weeks visit to Puerto Rico and Cuba, undertaken in connection with a project which will study the comparative growth of three sugar producing islands (Puerto Rico, Cuba, and Hawaii). The project is sponsored by the Food Research Institute, the Stanford Department of Economics, and the Social Science Research Council.

ROBERT S. OVERTON, formerly in the Agricultural Division of the Bureau of the Census, Department of Commerce, transferred to the Livestock Section of the Livestock and Poultry Statistics Branch on July 16, 1956.

J. K. PASTO, Pennsylvania State College, has been employed by FAO for the post of Farm Management Consultant beginning April 1.

BYRON S. PETERSON, formerly with the Office of Statistical Clearance and Standards transferred to position as Head of the Prices Received Section in the Agricultural Price Statistics Branch on August 12, 1956.

ROY POTAS of the Livestock Section, Livestock and Poultry Statistics Branch, transferred to the Dairy Statistics Branch as Head of the Milk Production and Utilization Section on May 20, 1956.

SYDNEY C. REAGAN of Southern Methodist University has been appointed a member of the Task Group on Oilseeds and Animal Fats of the President's Bipartisan Commission on Increased Industrial Use of Agricultural Products.

JAMES ROAN who received his LL.B. in Law at the State University of Iowa at the end of Fall Quarter, 1957, has enrolled at the Iowa State College Graduate College for graduate studies in economics. While continuing graduate work, Mr. Roan will be doing research under the Land Economics—Law Interdisciplinary Program with Iowa State College, the Agricultural Law Center of the College of Law and the USDA cooperating.

CHARLES F. SARLE, formerly with the National Analysts and for many years with the United States Department of Agriculture, joined the staff at the University of Florida as Professor of Agricultural Economics and Consultant to the Statistical Laboratory on February 1st.

ELBERT O. SCHLOTZHAUER, formerly Head of the Fruit and Nut Section of the Fruit and Vegetable Statistics Branch, transferred to the Technical Staff of the Food and Agriculture Organization at Guatemala, on November 6, 1956.

IVAN W. SCHMEDEMANN, Instructor in Agricultural Economics at Kansas State College, has resigned to accept a position in the Research Department of Standard Oil Company in Oklahoma City, Oklahoma.

GEORGE A. SCOTT, Statistician in Charge of the Agricultural Estimates Division, Sacramento, California office, retired on October 31, 1956 with more than 38 years of service.

RAYMOND C. SCOTT was appointed Director of the Division of Agricultural Economics Programs, Federal Extension Service, U. S. Department of Agriculture, December 18, 1956.

ARLAN R. SEMMEN, agricultural economist from the University of Minnesota, transferred to the Market Organization and Costs Branch in January 1957. He is doing work on special seed research.

CATHERINE J. SENF, formerly in the Special Statistics Branch, transferred to the analytical staff of the Food and Agriculture Organization at Thailand on January 22, 1957.

WILLIAM SHALLER joined the staff of the Farm Economics Research Division, ARS, in California, where he will work on a study of economic adjustments on California cotton farms. During the academic year, Mr. Shaller will be on a part-time basis.

GEOFFREY SHEPHERD has been granted a six-months leave of absence from the Department of Economics and Sociology, Iowa State College, to work with the government of the Union of Burma in Rangoon. He will advise and assist them in setting up a rice price analysis and market research unit in the State Agricultural Marketing Board.

JAMES C. SNYDER has joined the staff at Purdue University as an instructor in agricultural economics to do teaching and research in agricultural business management.

JOHN F. STEFFENS, JR., of the Agricultural Estimates Division, formerly with the Sacramento, California office, transferred to the Vegetable Section of the Fruit and Vegetable Statistics Branch in Washington, D.C. on January 14, 1957.

JAMES H. STEVENSON has joined the staff at Purdue University as marketing extension specialist in the consumer education program.

JAMES H. STREET has received an appointment under the State Department International Educational Exchange Program to deliver a series of lectures on economic development in the Argentine universities. He will be on leave from Rutgers University for the year beginning June, 1957.

JOHN W. THOMPSON, agricultural economist from Pennsylvania University, joined the Market Organization and Costs Branch in January 1957. He will be working on oil seeds and special crops in Washington, D.C.

F. L. UNDERWOOD, of Oklahoma A & M College, is on a year's leave of absence from May 19, 1956, serving as Fulbright Exchange Professor of Farm Management Research in the Department of Agricultural Economics at Hokkaido University, Sapporo, Japan.

JOE UNGER, Instructor in Agricultural Economics at Kansas State College, resigned January 31 to accept a position with Standard Oil Company of Oklahoma City.

RAYMOND E. VICKERY, formerly with the Research and Development Staff, transferred to the Grain and Feed Division of the Foreign Agricultural Service on March 22, 1957.

GEORGE WANGEN, JR., of the Agricultural Estimates Division, formerly of the Topeka, Kansas Office, transferred to the Livestock Section of the Livestock and Poultry Statistics Branch in Washington, D.C. on January 27, 1957.

G. BURTON WOOD, Head of the Department of Agricultural Economics at Oregon State College, has been appointed a member of the five-man advisory board of the Commodity Credit Corporation. This board meets every ninety days to confer with the Secretary of Agriculture on policy activities and operations of the Corporation.

DEGREES CONFERRED AND GRADUATE STUDENTS IN AGRICULTURAL ECONOMICS

Ph.D. Degrees Conferred

ABDUL SAHIB ALWAN, M.A. University of Southern California 1953; Ph.D. University of Wisconsin 1956, The Process of Economic Development in Iraq.

EMERSON M. BABB, JR., B.S. Virginia Polytechnic Institute 1951; M.S. Virginia Polytechnic Institute 1955; Ph.D. Pennsylvania State University 1957.

CHARLES HORACE BERRY, B.S. McGill University (Macdonald College) 1951; M.S. University of Connecticut 1953; Ph.D. University of Chicago 1956, Farm Employment 1940-50: A Cross-Sectional Analysis.

RAY V. BILLINGSLEY, B.S. Oklahoma A & M 1949; M.S. Oklahoma A & M 1952; Ph.D. North Carolina State College 1957, Programming Grain Movements to Determine Optimum Storage Locations in North Carolina.

HOWARD JACOB BONSER, Ph.D. Pennsylvania State University 1957, Rural Community Clubs in Tennessee—Their Bearing on Adoption of Farm and Home Practices.

MICHAEL JOSEPH BRENNAN, S.B.C. DePaul University 1952; M.A. University of Chicago 1954; Ph.D. University of Chicago 1956, The Role of Government in Butter Storage Operations.

CYRIL BRIGHT, B.S. University of Nebraska 1953; M.S. University of Wisconsin 1954; Ph.D. University of Wisconsin 1956, Characteristics of the Retail Feed Business in Wisconsin 1954.

DAVID WILLIAM BROWN, B.S. University of Connecticut 1953; M.S. Cornell University 1954; Ph.D. Iowa State College 1956, Adjustment of Value Productivity Estimates to Changes in Price and Technical Relationships.

ERNEST EVAN BROWN, B.S. Pennsylvania State University 1949; M.S. Pennsylvania State University 1951; Ph.D. University of Florida 1956, An Appraisal of and Recommendations for Increasing the Degree of Competition in Florida's Dairy Industry.

WILLIAM HENRY BURNS, B.S. Clemson Agricultural College 1948; M.S. Clemson Agricultural College 1952; Ph.D. Texas A & M 1956, The Role of Fiber Property Testing in the Operations of American Cotton Mills.

LUMAN EDWARD CAIRNS, B.S. Washington State College 1951; Ph.D. Iowa State College 1956, Response Functions of Farmers in Using Fertilizer.

HARVEY W. CALDWELL, B.S.A. Ontario Agricultural College 1951; M.S. Cornell University 1952; Ph.D. Oregon State College 1956, The Impact of Supplemental Irrigation on Farm Organization in Polk County, Oregon.

ELIZAH DENTON CHASTAIN, JR., B.S. Clemson College; M.S.; Ph.D. Purdue University 1956, An Empirical Study of the Decision-Making Process in Farm Management.

NORMAN RICHARDSON COLLINS, B.S. Kansas State College 1950; A.M. Harvard University 1956; Ph.D. Harvard University 1956, Gains in Profits from Flexible as Compared with the Inflexible Use of Resources.

MAYNARD CALVIN CONNER, B.S. University of Virginia 1936; M.S. Virginia Polytechnic Institute 1938; Ph.D. Cornell University 1957, Development and Analysis

of Costs for a Milk Pasteurizing and Bottling Plant with a Capacity of 15,000 Quarts Daily.

John Calvin Crecink, B.S. Mississippi State College 1943; M.A. University of Virginia 1948; Ph.D. Iowa State College 1956, How Tenant Farmers in the South Platte Valley, Colorado, Accumulate Capital and Obtain Farms.

William Aiken Stewart Cromarty, B.S.A. University of Toronto (Ontario Agricultural College) 1951; M.S. Michigan State University 1953; Ph.D. Michigan State University 1957, Economic Structure in Agriculture.

Velmar Walk Davis, B.S. Purdue University 1948; M.S. Purdue University 1949; Ph.D. University of Illinois 1956, Economics of Field Sheeling and Artificial Drying of Corn in Illinois.

Howard Rissell Dorsett, B.S. Oklahoma A & M College 1946; Ph.D. Iowa State College 1956, Intra-family Transfers of Farm Property in Jefferson County, Iowa.

Riley Shelton Dougan, B.S. Ohio State University 1948; M.S. Ohio State University 1951; Ph.D. Ohio State University 1956, An Analysis of the Use of Economic Information in Farm Production Decisions by Ohio Farmers.

Vance Ward Edmondson, B.S.A. University of Arkansas 1948; M.S. Oklahoma A & M 1950; Ph.D. Cornell University 1956, Farm Business Adjustments of Commercial Dairy Farms, Montgomery County, New York, 1944-45 to 1954-55.

Homer C. Evans, B.S. University of Kentucky 1947; M.S. University of Kentucky 1948; Ph.D. University of Minnesota 1956, The Nature of Competition Among Apple Processors in the Appalachian Area.

William Lyle Fitzgerald, B.S. University of Missouri 1947; M.A. University of Missouri 1949; Ph.D. University of Illinois 1956, Decision Making in Packer Procurement of Hogs.

Donald K. Freebairn, B.S. University of Illinois 1950; M.S. University of Illinois 1952; Ph.D. Cornell University 1957, An Analysis of Farm Financial Progress of Selected Farmers in New York State.

John Edward Greenfield, B.S. University of Illinois; M.S.; Ph.D. Purdue University 1956, A Planning Technique for Farmer's Insurance Needs.

Albert Nelson Haltar, B.S. Iowa State College 1952; M.S. Iowa State College 1953; Ph.D. Michigan State University 1956, Marginal Utility of Income Among Farmers.

Khalil Abdel Ghani Hamouda, B.S. Alexandria University, Egypt 1946; M.S. University of Minnesota 1953; Ph.D. University of Minnesota 1956, Economic Aspects of the Application of Cooperative Farming in Egypt.

Lawrence Wilber Haynes, B.S.A. University of Wisconsin 1936; Ph.D. University of Wisconsin 1956, An Analysis of the Ice Cream Industry as an Outlet for Dairy Products.

William R. Henry, B.S. University of Arkansas 1948; M.S. University of Arkansas 1953; Ph.D. North Carolina State College 1957, North Carolina in an Interregional Competitive Broiler Market.

Irving Joseph Hoch, Ph.B. University of Chicago (College) 1945; M.A. University of Chicago 1951; Ph.D. University of Chicago 1957, Estimation of Agricultural Resource Productivities Combing Time Series and Cross Section Data.

S. M. AIJAZ HUSAIN, B.S. Agricultural College, Kanpur, India 1937; M.S. Iowa State College 1949; Ph.D. Iowa State College 1957, Optimum Resource Allocation for Erosion Control Farming on Ida-Monona Soils.

ARTHUR D. JEFFREY, B.S.; Pennsylvania State University 1939; M.S. Pennsylvania State University 1953; Ph.D. Pennsylvania State University 1956.

PAUL LEO KELLEY, B.S. Kansas State College 1943; M.S. Kansas State College 1946; Ph.D. Iowa State College 1956, Resource Returns and Productivity Coefficients for the Kansas Cooperative Grain Elevator Industry.

RALPH G. KLINE, B.S. Pennsylvania State College 1940; M.S. Pennsylvania State College 1952; Ph.D. North Carolina State College 1956, An Economic Analysis of Production Possibilities of Selected Harvested Forage Crops, Piedmont Areas, N.C.

JOSEPH W. KOUDELE, B.S. University of Nebraska 1943; M.S. University of Minnesota 1947; Ph.D. Michigan State University 1956, An Economic Analysis of Trading in Egg Futures, 1934-54.

JOHN LUDWIG KUPKA, B.S. Cornell University 1950; M.S. Purdue University 1953; Ph.D. Cornell University 1956, A Study of Flower Merchandising in Self-Service Outlets.

MARION ROSSLYN LARSEN, B.S. Utah Agricultural College 1947; M.S. Utah Agricultural College 1948; Ph.D. University of Maryland 1957, Competitive and Marketing Aspects of the Maryland Cantaloupe Industry.

ROY LELAND LASSITER, JR., B.S. University of Florida 1953; M.A. University of Florida 1955; Ph.D. University of Florida 1957, An Analysis of the Movements in Agricultural Land Prices and Values in Palm Beach County, Florida, 1940-1955.

ELMER W. LEARN, B.S. Pennsylvania State University 1950; M.S. Pennsylvania State University 1951; Ph.D. Pennsylvania State University 1957.

THEODORE WM. LEED, B.S. Ohio State University 1950; M.S. Ohio State University 1951; Ph.D. Ohio State University 1957, A Study of the Relationship of Merchandizing Practices and Other Factors to the Price and Movement of Greenhouse Tomatoes in Retail Food Stores.

HAROLD CLYDE LOVE, B.S. Kansas State College 1933; M.S. Kansas State College 1952; Ph.D. Iowa State College 1956, An Application of Linear Programming to Farm and Home Planning.

PATRICK J. LUBY, B.S. University of Dayton; M.S. Ph.D. Purdue University 1956, Methodology Applicable to Short-Run Prediction of Marketing and Prices of Hogs.

MURRAY ALEXANDER MACGREGOR, B.S.A. Ontario Agricultural College 1951; M.S.A. Cornell University 1953; Ph.D. Cornell University 1956, Uniformity Trial Experiments in Marketing Research.

ARTHUR BUREN MACKIE, B.S. North Carolina State College 1949; M.S. North Carolina State College 1953; Ph.D. Iowa State College 1956, Optimum Farm Plans for Beginning Farmers in Central Iowa: An Application of Linear Programming.

WILBUR R. MAKI, B.A. University of Michigan 1948; M.A. University of Michigan 1949; M.S. Iowa State College 1954; Ph.D. Iowa State College 1956, Financial Organization in Farmer Cooperatives.

JOE ALLEN MARTIN, B.S. Clemson College 1946; M.S. Clemson College 1947; Ph.D. University of Minnesota 1956, Impact of Industrialization Upon Agriculture.

ROBERT HUBERT MCALEXANDER, B.S. Iowa State College 1949; M.S. Oregon State College 1953; Ph.D. Iowa State College 1956, Optimum Feed Combinations and Market Weights for Broilers Based on Two-variable Production Functions.

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BENNIE CHARLES ROBINSON, B.S. Northeast Louisiana State College 1956; M.S. Louisiana State University 1958.

JOHN ALLEN ROGALLA, B.S. California Polytechnic State College 1956; M.S. Cornell University 1957.

CHARLES E. ROGERS, B.S. Murray State College 1955; M.S. University of Illinois 1957, Analysis of Growth of Grain Elevator Farms.

JAMES BERGEN ROOF, B.S. Rutgers University 1954; M.S. Michigan State University 1957, Effects of the Soil Bank on Cropping Practices in Michigan.

HOLLIS URIE ROWELL, B.S. University of Vermont 1956; M.S. Cornell University 1957, Aggregate Input-Output Study of St. Lawrence County, New York.

LEROY CAROL RUDE, B.S. North Dakota Agricultural College 1953; M.S. North Dakota Agricultural College 1957, Investigation of Cattle Feeding in North Dakota.

WILLIAM LEE RUGGELS, B.S. Kansas State College 1956; M.S. Kansas State College 1957, Economic Aspects of a Proposed Wheat Program.

PATRICK ALVAN RUSH, B.S. Indiana University 1954; M.S. Clemson College 1958, Economic Effects of Rural Industrialization.

IRVING A. RUSSELL, B.S. ATC, Greensboro, North Carolina; M.A. University of Nebraska 1958.

ROY OTIS RUSSELL, JR., B.S. Alabama Polytechnic Institute 1956; M.S. Alabama Polytechnic Institute 1958, Livestock Marketing in Alabama.

HORACE GLYNN SALMON, B.S.A. Murray State College 1952; M.S.A. University of Kentucky 1958, Agricultural Credit.

PATROCINIO VALENQUELA SANTOS, B.S.E. University of the Philippines 1952; M.S. Cornell University 1957, School Administration and Finance in the Philippines.

IVAN WAYNE SCHMEDEMANN, B.S. Kansas State College 1953; M.S. Kansas State College 1957, An Evaluation of Selected Conservation Practices in the Snipe Creek Watershed, Marshall County, Kansas.

A. ALLAN SCHMID, B.S. University of Nebraska 1956; M.A. University of Wisconsin 1957, The Impact of the Soil Bank on the Availability of Farm Land in Rock County, Wisconsin.

ROBERT E. SCHNEIDAU, B.S. Purdue University 1956; M.S. Purdue University 1957, Patterns in Receipts of Livstock at Selected Markets—Problems and Causes.

STANLEY R. SCHULTZ, B.S. Ohio Wesleyan 1951; M.S. Ohio State University 1957.

ALBERT DONALD SEABORG, B.S. University of Wisconsin 1954; M.S. University of Wisconsin 1958.

RAYMOND GLEN SEEMAN, B.S. University of Idaho 1955; M.S. University of Idaho 1957, Marketing Idaho Dry Beans.

ALLAN M. SEVERSON, B.S. South Dakota State 1956; M.S. South Dakota State 1957, Obstacles to Soil Bank Participation by South Dakota Wheat Farmers.

ROBERT ARTHUR SHAW, B.S. Michigan State University 1953; M.S. Michigan State University 1958, Market Structure for Red Cherries.

GERALD WILCOX SHELDEN, B.S. Ohio State University 1953; M.S. Ohio State University 1957, An Analysis of the Sale of Inexpensive Cut Flowers and Potted Plants Through Super Markets in Columbus, Ohio.

KWAT SOEN SIE, B.S. University of Indonesia 1950; M.S. Cornell University 1957.

Hugo Collins Sieler, B.S. University of Nebraska 1956; M.A. University of Nebraska 1957.

Fay M. Sims, B.S. University of Illinois 1941; M.S. University of Illinois.

Narpati Singh, B.S. A.S. Jat College, Lakhoali, U.P. India; M.S. Ohio State University 1958.

Billy Ray Skelton, B.S. Clemson College 1956; M.S. Clemson College 1957, In Field of Production Economics.

George Aiken Slappey, B.S.A. University of Georgia 1956; M.S. University of Georgia 1957, Economic Analysis of Fertilizer Plot Data for Bahia Grass and Corn at the Georgia Southwest Branch Experiment Station.

William Floyd Slingsby, B.S. University of Wisconsin 1956; M.S. North Dakota Agricultural College 1958.

Blair J. Smith, B.S. Pennsylvania State University 1953; M.S. Pennsylvania State University 1958.

David Rackliffe Smith, B.S. University of Maine 1953; M.S. University of Maine 1957.

Irving Dwight Smith, B.S. Cornell University 1951; M.S. Purdue University 1958.

Olin Cecil Smith, B.S.A. University of Georgia 1950; M.S. University of Georgia 1957, A Budgetary Analysis of the Economics of Piedmont Farms in Georgia By Size and Type.

Richard J. Spady, B.S. University of Nebraska 1956; M.A. University of Nebraska 1958.

Carrol Davonne Spencer, B.S. Kansas State College 1956; M.S. Kansas State College 1957, A Problem in Wheat Price Policy.

Robert D. Spencer, B.S. University of Delaware 1957; M.S. University of Delaware 1958.

Robert Frederick Sprunger, B.S. Purdue University 1953; M.S. Purdue University 1957, Accuracy of Pricing and Grading of Wheat at Local Elevators.

Doyle Spurlock, B.S. Universtiy of Nevada 1956; M.S. Purdue University.

Robert J. Stalcup, M.A. University of Nebraska 1957.

Clyde John St Clergy, B.S. Southwestern Louisiana Institute 1956; M.S. Louisiana State University 1958, Livestock Marketing in Louisiana.

Earl T. Steiner, B.S. Ohio State University 1956; M.S. Ohio State University 1957.

Earl Walker Stewart, B.S.A. University of British Columbia 1956; M.S.A. University of British Columbia 1958.

Sidney Stiefel, B.S. Kansas State College 1950; M.S. Ohio State University 1957.

John Fred Stollsteiner, B.S. Michigan State University 1953; M.S. Michigan State University 1957, The Effects of Government Loan and Purchase Programs Upon the Commercial Marketings and Domestic Utilization of Farm Products in the Postwar Period.

John Guy Stovall, B.S. Tennessee Polytechnic Institute 1954; M.S.A. University of Kentucky 1958.

Charles Lyman Streeter, B.S. Kansas State College 1941; M.S. Kansas State College 1958, Economics of Scale in Cooperative Marketing Firms of Kansas.

MARY ELIZABETH STRICKLAND, B.S. Michigan State University 1953; M.S. Michigan State University 1957, Evaluation of Consumer Marketing Information Program as to Change in Level of Knowledge and Behavior Habits.

GENE DALE SULLIVAN, B.S. Arkansas State College 1955; M.S. Louisiana State University 1957, An Economic Analysis of Cotton Irrigation in North Louisiana.

HARRY A. SULLIVAN, B.S. University of Missouri 1956; M.S. University of Missouri 1958.

CHESTER E. SWANK, B.S. Ohio State University 1950; M.S. Ohio State University 1957, An Analysis of Marketing Information for Consumers in Ohio.

IICHIRO TAKAHASHI, B.A. Keio University, Tokyo 1947; M.A. Cornell University 1957, Part-time Farming in St. Lawrence County, New York.

SHIRO TAKEI, B.S. University of Hawaii 1938; M.S. Michigan State University 1957, Contribution of a Marketing Education and Information Program to the Marketing of Fresh Fruits and Vegetables in Hawaii.

BYRON EUGENE TAYLOR, B.S. Kansas State College 1955; M.S. Kansas State College 1958, The Effect of Farm Supply Activities Upon the Efficiency of Co-Operative Grain Elevator Operation.

KENNETH R. TEFERTILLER, B.S. Oklahoma A & M 1952; M.S. Oklahoma 1957, Rates of Concentrate—Roughage Substitution and Economic Optimums in Feeding Yearling Steers and Heifers.

MAURICE ELTON THIGPEN, B.S. North Carolina State College 1954; M.S. North Carolina State College 1959.

EARLE K. THOMPSON, B.S. University of Minnesota 1953; M.S. University of Minnesota 1957.

SIDNEY JAMES TIETEMA, B.S. Montana State College 1951; M.S. Montana State College 1958, Formal and Informal Education Methods for Indians in Agriculture.

WILLIAM G. TOMEK, B.S. University of Nebraska 1956; M.A. University of Nebraska 1957.

WILLIAM ANSEL TOMPKINS, B.S. University of Illinois 1954; M.S. University of Illinois 1958.

MIGUEL A. TORRADO, B.S. College of Agriculture, Mayaguez, Puerto Rico 1950; M.S. Cornell University 1957, Production and Marketing of Pineapples in Puerto Rico.

MARVIN WAYNE TRAUTWEIN, B.S. University of Illinois 1956; M.S. Iowa State College 1957-58.

KUO-FANG TUNG, B.S. Taiwan Provincial College of Agriculture, Taichung, Taiwan 1955; M.S.A. University of Kentucky 1958.

SAMUEL CHARLES TURNER, B.S. University of Missouri 1956; M.S. University of Missouri 1957, Farm Resource Allocation in Ozarks of Southeastern Missouri.

WILLIE GLENN TUSSEY, B.S. North Carolina State College 1949; M.S. North Carolina State College 1958, Economics of Scale in Cotton Ginning.

LUTHER G. TWEETEN, B.S. Iowa State College 1954; M.S. Oklahoma A & M 1957, Economic Analysis of Broomcorn Production in Oklahoma.

JOHN RICHARD UNGER, B.S. Kansas State College 1956; M.S. Kansas State College 1957, Marketing Inefficiency, Production Uncertainty and Price Fluctuations of Roughages in Kansas.

Rolan Eugene Vanausdal, B.S. Ohio State University 1953; M.S. Ohio State University 1957.

Louis Andrew Varcha, B.S. Michigan State College 1954; M.S. Michigan State University 1958, Rural-Urban Fringe Problem.

Gloria Revilleza Vega, B.S. University of the Philippines 1953; M.S. 1957, Family Expenditures of Rural Families in Calolay, Binan, Laguna.

Duane George Vonlanken, B.S. University of Illinois 1953; M.S. University of Illinois 1957, Labor Inputs on Northern Illinois Hog Farms.

Duane George Vonlanken, B.S. University of Illinois 1953; M.S. University of Illinois 1958.

Melvin M. Wagner, B.S. University of Illinois 1954; M.S. University of Illinois 1958.

Willis Barton Waite, B.S. Cornell University 1932; M.S. Cornell University 1957, Jersey Vs. Holstein Cows in Delaware County, New York.

Donald Lee Walker, B.S. University of Idaho 1955; M.S. University of Idaho 1957, The Effect of Alternative Methods of Harvesting Forages on Net Farm Income.

Francis Edwin Walker, B.S. University of Illinois 1954; M.S. University of Illinois 1957, The Effect of Price Policy on Pork Production.

Kenneth H. Walker, B.S. Pennsylvania State University; M.S. Pennsylvania State University.

Odell Larry Walker, B.S. Oklahoma A & M 1952; M.S. Oklahoma A & M 1957, Adjustment Alternatives for North Central Oklahoma Wheat Farmers.

Thomas Dudley Wallace, B.S. Oklahoma A & M 1956; M.S. Oklahoma A & M 1957, An Econometric Model of the Beef Industry.

Hsin-Fu Wang, B.S. National Central University, Nanking, China 1957; M.S. Michigan State 1957, Demand for Meals Away from Home.

You-Tsao Wang, B.S. National Taiwan University, China 1952; M.S. Iowa State College 1957.

William K. Waters, B.S. Pennsylvania State University 1953; M.S. Pennsylvania State University 1957.

Clyde Raymond Weathers, B.S. North Carolina State College 1951; M.S. North Carolina State College 1958.

Jan Harry J. M. Weijs, B.S.A. Ontario Agricultural College 1956; M.S. University of Manitoba 1957, A Study of Steer-Heifer Price Differentials.

John Edward Weil, B.S. University of Connecticut 1954; M.S. University of Connecticut 1957, Economic Effects of Alternative Methods of Transporting Milk in Dairy Stables.

Charles L. Welling, B.S. University of Wyoming 1954; M.S. Utah State Agricultural College 1958, Economic Evaluation of Capital Outlay Required for Alternative Methods of Irrigation.

Arnold George Wennmacher, B.S. Purdue University 1956; M.S. University of Illinois 1958.

Eldon H. Wheeler, B.S. University of Arizona 1956; M.S. University of Arizona

1957, Records—Methods of Keeping, Their Uses, and Place In Management of Arizona Farms and Ranches.

ROBERT ELI WHITE, JR., B.S. University of Illinois 1956; M.S. University of Illinois 1958.

JOHN THOMAS WILKIN, B.S. Iowa State College 1953; M.S. Iowa State College 1957, Area of Effects of Government Storage Programs in the Grain Trade.

FRANK HARMON WILLEY, B.S. University of Illinois 1954; M.S. University of Illinois 1957.

BERNIS EARL WILLIAMSON, B.S. Northeast State College, Louisiana 1954; M.S. Louisiana State University 1959.

THOMAS WILSON, B.S. Ohio State University 1955; M.S. Ohio State University 1957.

JOSEPH ELROY WINSETT, B.S. University of Tennessee 1956; M.S. University of Tennessee.

REGINALD JAMES WOODBURN, B.S. Montana State College 1953; M.S. Montana State College 1957, An Analysis of Marketing Lambs from Montana Feedlots.

WILLARD FRANKLIN WOOLF, B.S. Arkansas State College 1955; M.S. Louisiana State University 1957, Labor and Material Requirements for the Major Farm Enterprises in the Louisiana Rice Area.

JACK BOYD WOOLLEY, B.S. Arizona State College 1954; M.S. University of Arizona 1957, Economic Study of Skip-Row Vs. Solid Planted Cotton.

CALVIN WRIGHT, B.S. Oklahoma A & M 1955; M.S. Oklahoma A & M 1957.

NORMAN E. WRIGHT, B.S. Brigham Young University, Utah 1956; M.S. Utah State Agricultural College 1958, Costs of Marketing Utah Lambs at Alternative Markets.

NORMAN GENE WRIGHT, B.S. West Virginia University 1953; M.S. University of Arizona 1957, Economic Analysis of Cattle Feeding Efficiency in Arizona, 1941-1956.

RICHARD HILL WRIGHT, B.S. Texas A & M 1957; M.S. Texas A & M 1958, Land Economics.

IVAN F. WYMORE, B.S. Colorado A & M 1955; M.S. Colorado A & M 1957, Training Colorado County Agricultural Agents for Farm and Home Development Work.

NATHANIEL ALEXANDER WYNN, JR., B.S.A. University of Georgia 1953; M.S. Clemson College 1958, Economic Aspects of Hog Production in South Carolina.

FRANCIS P. YAGER, B.S. University of Missouri 1951; M.S. University of Missouri 1958, Grain Marketing.

SHOKO YAMASOTA, B.S. Michigan State University 1955; M.S. Michigan State University 1957.

MEZMUR YEHEYES, B.A. University College of Addis Ababa 1956; M.S. University of Illinois 1958.

KEITH K. YOUNG, B.S. University of Nebraska 1951; M.A. University of Nebraska 1958.

LAWRENCE SIMEON YOUNG, B.S.A. University of British Columbia 1942; M.S.A. University of British Columbia 1958.

DONALD ZEHR, M.S. Ohio State University 1958.

ANNOUNCEMENT OF THE AMERICAN MARKETING ASSOCIATION'S MEETING IN DETROIT, MICHIGAN JUNE 19-21, 1957

"Members of AFEA are invited to attend 40th National Conference of the American Marketing Association, June 19-20-21, 1957 in Detroit, Michigan. The general theme of the conference is "Marketing's Role in Scientific Management." One of the special interest sessions scheduled for 10:30 A.M. to 12:00 M. on June 20 has been arranged with the cooperation of members of AFEA and consists of the following:

Agriculture: "The 32 Billion Dollar Challenge: Horse and Buggy Concepts of Agriculture May Be Robbing You of Sales"
Chairman: Victor Hawkins, Director of Research, Capper Publications, Inc., Topeka, Kansas
"Agriculture is a Growth Industry"
Charles W. Russell, Marsteller, Rickard, Gebhardt and Reed, Inc., Chicago, Illinois
"Industry's Chief Resource and Partner"
Ray A. Goldberg, Asst. Professor of Business Administration, Graduate School of Business Administration, Harvard University, Boston, Massachusetts
Discussants: Vernon W. Ruttan, Asst. Professor Agricultural Economics, Purdue University, Lafayette, Indiana;
Herman Southworth, United States Dept. of Agriculture, Washington, D.C.

"It should be noted that the fee for attendance at each AMA Conference session is $3.00. Participation in the entire conference entails a fee of $26.00 ($24.00 if paid in advance) which includes 3 luncheons and one breakfast, as well as admission to all sessions."

ANNOUNCEMENT OF TOBACCO LITERATURE SERVICE

North Carolina State College recently announced the establishment of the world's first Tobacco Literature Service and the publication of its first volume of *Tobacco Abstracts,* now being distributed on an international basis.

Dr. H. Brooks James, Head of the Department of Agricultural Economics, North Carolina State College, points out that this is a joint undertaking of the D. H. Hill Library and the Agricultural Experiment Station. It will maintain its headquarters in the Library and will be financed largely by the Experiment Station. Miss Margaret Drenowatz, a native of New Jersey and a graduate of Rutgers University Library School, has been named full-time head of the unique Tobacco Literature Service.

The Service will assemble and publish abstracts of literature on tobacco for distribution to tobacco scientists throughout the world. It also will provide library staff service at State College for any tobacco scientist.

It was pointed out that the idea for the Literature Service developed as an outgrowth of a need expressed by tobacco scientists at State College for assistance in assembling and reviewing technical literature for tobacco in the various fields of science. Dr. Ralph Shaw, Professor of Library Science at Rutgers University, President of the American Library Association, and former Director of the U. S. Department of Agriculture Library, is a consultant on this project.

The monthly issues of *Tobacco Abstracts* are being made available to libraries in the United States and in certain other countries.

TENTATIVE PROGRAM
AMERICAN FARM ECONOMIC ASSOCIATION
LAKE JUNALUSKA, NORTH CAROLINA
AUGUST 28-31, 1957
Program Schedule

WEDNESDAY, AUGUST 28

9:00 A.M. Executive Committee Meeting
2:00 P.M. Registration
7:00 P.M. Meeting of Student Officers and Student Section Committee
7:30 P.M. Reception

THURSDAY, AUGUST 29

8:00 A.M. Registration
8:30- 9:00 A.M. Student Section Business Meeting
9:00-10:00 A.M. Opening Session
10:00-12:00 M. General Session
1:30- 3:30 P.M. Section Meetings
1:30- 3:30 P.M. Presentation and Discussion of Graduate Student Papers
3:30- 6:00 P.M. Free Time (Recreation, Farm Tours, Visiting, Etc.)
3:30- 4:30 P.M. First Round Student Debates
6:00 P.M. Outdoor Dinner
8:00 P.M. Entertainment

FRIDAY, AUGUST 30

8:30- 9:45 A.M. Business Meeting
8:30- 9:45 A.M. Second Round Student Debates
10:00-12:00 M. General Session
1:30- 3:30 P.M. Section Meetings
1:30- 3:30 P.M. Student Public Speaking Contest
3:30- 6:00 P.M. Free Time (Recreation, Farm Tours, Visiting, Etc.)
3:30- 4:30 P.M. Third Round Student Debates
7:30- 9:30 P.M. Recognition and Awards Program

SATURDAY, AUGUST 31

8:30- 9:30 A.M. Student Section Business Meeting
8:30-10:45 A.M. Section Meetings
11:00-12:00 M. General Session
2:00 P.M. Executive Committee Meeting

Thursday, August 29, 1957

OPENING SESSION—9:00-10:00 A.M.

Chairman: H. Brooks James, North Carolina State College
Welcome: D. W. Colvard, Dean of Agriculture, North Carolina State College
Address: Harry Trelogan, (President-elect, AFEA), Agricultural Research Service, USDA

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GENERAL SESSION—10:00 A.M. -12:00 M.

RESOURCE USE AND AGRICULTURAL POLICY
Chairman: Joseph Ackerman, Farm Foundation

Resources Needed in American Agriculture
Speaker: J. D. Black, Professor Emeritus, Harvard University
Discussant: Karl Brandt, Food Research Institute
Guiding Agricultural Adjustments
Speaker: K. A. Fox, Iowa State College
Discussant: W. W. Cochrane, University of Minnesota

SECTION MEETINGS—1:30-3:30 P.M.

SECTION I. IMPACT OF THE SOIL BANK
Chairman: T. R. Timm, Texas A & M College
Impact of the "Acreage Reserve" on Resource Adjustments in Agriculture
Speaker: J. C. Bottum, Purdue University
Discussant: L. W. Witt, Michigan State University
Impact of the "Conservation Reserve" on Resource Adjustments in Agriculture
Speaker: Donald Kaldor, Iowa State College
Discussant: Lyle M. Bender, South Dakota State College

SECTION II. TECHNOLOGY, POLICY, AND THE MILK INDUSTRY

Chairman: R. W. Bartlett, University of Illinois
Impacts of Technological Developments on the Supply and Utilization of Milk
Speaker: Charles E. French, Purdue University
Discussant: Louis Herrmann, Agricultural Marketing Service, USDA
Economic Effects of Regulation and Price Fixing in the Milk Industry
Speaker: G. K. Brinegar, University of Connecticut
Discussant: D. D. Brown, Mutual Federation of Independent Cooperatives Syracuse, New York

SECTION III. FUTURE PRODUCTION REGIONS FOR POULTRY

Chairman: D. W. Parvin, Mississippi State College
Broiler Production Regions of the Future
Speaker: W. R. Henry, North Carolina State College
Discussant: C. K. Laurent, University of Georgia
Commercial Egg Production Regions of the Future
Speaker: Ralph Baker, Pennsylvania State University
Discussant: H. E. Lazelere, Michigan State University

SECTION IV. IMPROVING RESEARCH IN AGRICULTURAL ECONOMICS

Chairman: G. H. Aull, Clemson College
Methodology for Studying Decision Making
Speaker: Glenn Johnson, Michigan State University
Discussant: W. B. Back, Oklahoma A & M College
Integrating the Sciences in an Effective Research Program in the Land-Grant Colleges
Speaker: E. R. Kiehl, University of Missouri
Discussant: John Schnittker, Kansas State College

SECTION V. WATER PRODUCTIVITY AND PROBLEMS

Chairman:
The Productivity of Water in Agriculture
Speaker: John Dawson, University of Chicago
Discussant: Kris Kristjanson, Department of Northern Affairs and National Resources, Ottawa, Canada
Economic Evaluation of the Small Watershed Program
Speaker: Fred Clarenbach, Agricultural Research Service, USDA
Discussant: E. L. Baum, Division of Agricultural Economics, TVA

SECTION VI. COOPERATIVES IN A CHANGING AGRICULTURE

Chairman: Ken Stern, American Institute of Cooperatives, Washington 6, D. C.
The Role of Cooperatives in Bargaining
Speaker: Robert Clodius, University of Wisconsin
Discussant: Claud Scroggs, University of Tennessee
The Role of Cooperatives in Efficient Distribution
Speaker: M. A. Abrahamsen, Farmer Cooperative Serivce, USDA
Discussant: W. C. Binkley, University of Kentucky

SECTION VII. CHANGING PATTERNS OF CONSUMPTION

Chairman: Aubrey Brown, University of Kentucky
Implications of Changing Patterns of Consumption, Preferences, and Motivations
Speaker: Herman Southworth, Agricultural Marketing Service, USDA
Discussant: G. G. Quackenbush, Michigan State University
New Methods of Measuring Consumer Preferences and Motivations
Speaker: F. P. Kilpatrick, Director of Research Development, National Analysts, Inc.
Discussant: Marguerite C. Burk, Agricultural Marketing Service, USDA

SECTION VIII. ADJUSTING AGRICULTURE TO ECONOMIC GROWTH

Chairman: O. R. Johnson, University of Missouri
The Role of Production Economics in the Problem of Agricultural Adjustment
Speaker: Sherman Johnson, Agricultural Research Service, USDA
Discussant: M. S. Williams, National Plant Food Institute, Washington, D. C.
Progress of Agriculture Toward Adjustment
Speaker: Earl O. Heady, Iowa State College
Discussant: J. G. McNeely, Texas A & M College

SECTION IX. SUCCESSFUL PLANNING WITH FARMERS

Chairman: B. T. Lanham, Jr., Alabama Polytechnic Institute
Four Years of Planning With Farmers in Parker Branch Watershed
Speaker: A. J. Coutu, North Carolina State College
Discussant: R. G. Wheeler, Michigan State University
Appraisal of Farm and Home Development Programs
Speaker: E. J. Nesius, University of Kentucky
Discussant: S. B. Weeks, University of New Hampshire

Section X. RESEARCH AND EXTENSION FOR TOMORROW

Chairman: P. L. Putnam, University of Connecticut

Optimum Allocation of Research Resources in a Dynamic Agriculture
Speaker: J. S. Plaxico, Oklahoma A & M College
Discussant: Robert G. Spitze, University of Tennessee

How to Keep Extension Resources Properly Allocated in a Dynamic Agriculture
Speaker: Jack Claar, Federal Extension Service, USDA
Discussant: W. F. Henry, University of New Hampshire

Friday, August 30, 1957

GENERAL SESSION—10:00 A.M.-12:00 M.

FOREIGN TRADE AND AGRICULTURAL POLICY

Chairman: Alex H. Turner, Past-President, Canadian Agricultural Economics Society

Agricultural Trade in Relation to U. S. Foreign Policy
Speaker: Lauren K. Soth, *Register and Tribune,* Des Moines, Iowa
Discussant: D. Gale Johnson, University of Chicago

The Role of United States Agriculture in World Affairs
Speaker: Walter W. Wilcox, Library of Congress
Discussant: William H. Nicholls, Vanderbilt University

SECTION MEETINGS—1:30-3:30 P.M.

Section I. MODERN FARM MANAGEMENT

Chairman: Lee Langsford, Agricultural Research Service, USDA

Dealing With Problems of Uncertainty in Farm Planning
Speaker: Clifford Hildreth, Michigan State University
Discussant: Dale A. Knight, Kansas State University

The Respective Roles of Survey and Experiment in Farm Management Research
Speaker: T. E. Tramel, Mississippi State College
Discussant: Don Kanel, University of Nebraska

Section II. SOLUTIONS TO THE LOW INCOME PROBLEM

Chairman: H. C. M. Case, University of Illinois

The Solution to the Low Income Problem in the South
(1) *Industrialization*
Speaker: Rufus Hughes, Jr., AIDC, Little Rock
Discussant: W. E. Hendrix, Agricultural Research Service, USDA
(2) *Farm Reorganization*
Speaker: Roger Woodworth, University of Georgia
Discussant. Vernon C. Johnson, A & T College, Greensboro, North Carolina

Section III. INTEGRATION OF PRODUCTION, PROCESSING, AND MARKETING

Chairman: Larry Boger, Michigan State University

Vertical Integration in the Tomato Processing Industry
Speakers: W. F. Mueller, University of Wisconsin
Norman R. Collins, University of California
Discussant: Milton M. Snodgrass, Purdue University

An Appraisal of Vertical Integration in the Broiler Industry
    Speaker: Stanley K. Seaver, University of Connecticut
    Discussant: John Davis, Harvard University

SECTION IV. THE LAND MARKET AND ECONOMIC DEVELOPMENT

    Chairman: R. E. Huffman, Montana State College
Prevailing Land Market Forces
    Speaker: William H. Scofield, Agricultural Research Service, USDA
    Discussant: Frank Maier, Agricultural Research Service, USDA
Economic Development and Competition for Land Use in the United States
    Speaker: Philip Raup, University of Minnesota
    Discussant: W. L. Gibson, Jr., Virginia Polytechnic Institute

SECTION V. FOREIGN TRADE

    Chairman: G. M. Beal, University of Maryland
Developing Foreign Markets Through Local Currency Projects
    Speaker: George J. Dietz, American Farm Bureau Federation, Washington, D.C.
    Discussant: Gordon O. Fraser, Foreign Agricultural Service, USDA
The Role of the Agricultural Attaché in Promoting Foreign Trade
    Speaker: Robert C. Tetro, Foreign Agricultural Service, USDA
    Discussant: Montague Yudelman, Rockefeller Foundation, New York

SECTION VI. TECHNOLOGY AND AGRICULTURAL PROGRESS

    Chairman: Kenneth Bachman, Agricultural Research Service, USDA
Differential Rates of Growth in Output Per Unit of Input in Agriculture
    Speaker: Glenn Barton, Agricultural Research Service, USDA
        Ralph A. Loomis, Agricultural Research Service, USDA
    Discussant: Harald Jensen, Purdue University
Agricultural Versus Non-Agricultural Growth in Output Per Unit of Input
    Speaker: Vernon Ruttan, Purdue University
    Discussant: Ken Robinson, Cornell University

SECTION VII. CREDIT IN A CHANGING AGRICULTURE

    Chairman: Ivy W. Duggan, Trust Company of Georgia, Atlanta, Georgia
Credit Needed for American Agriculture and Its Relation to Surpluses
    Speaker: Larry Kreider, American Bankers' Association, 12 East 36th Street, New York 16, New York
    Discussant: Dale Hathaway, Michigan State University
The Role of Intermediate Credit in a Changing Agriculture
    Speaker: Robert Darr, Federal Intermediate Credit Bank, Columbia, South Carolina
    Discussant: J. H. Atkinson, Purdue University

SECTION VIII. AN EVALUATION OF MARKETING RESEARCH AND EXTENSION

    Chairman: C. B. Ratchford, N.C. State College
A Critical Evaluation of Agricultural Marketing Research
    Speaker: R. L. Kohls, Purdue University
    Discussant: O. V. Wells, Agricultural Marketing Service, USDA
A Critical Appraisal of Agricultural Marketing Extension Education

Speaker: Raymond C. Scott, Federal Extension Service, USDA
Discussant: L. W. Schruben, Kansas State College

Section IX. AGRICULTURE AT THE CROSSROADS

Chairman: Mervin G. Smith, Ohio State University
The Status of Farm People in the United States
   Speaker: Ray Penn, University of Wisconsin
   Discussant: Joe R. Motheral, Agricultural Research Service, USDA
Alternatives to Orthodox Programs and Goals of Agricultural Adjustment
   Speaker: George Brandow, Pennsylvania State University
   Discussant: Harold Halcrow, University of Connecticut

Section X. CAUSES AND EFFECTS OF PRICE VARIATIONS FOR LIVESTOCK

Chairman: H. G. Hamilton, University of Florida
Effect of Short-Run Price Variations on the Meat Packing Firm
   Speaker: Elliot S. Clifton, John Morrell and Company Ottumwa, Iowa
   Discussant: Gerald Engelman, Agricultural Marketing Service, USDA
Pricing of Cattle at Southern Auctions with Emphasis Upon Factors Affecting Price and Farmer Price Uncertainty
   Speaker: Jack D. Johnson, Virginia Polytechnic Institute
   Discussant: W. K. McPherson, University of Florida

Saturday, August 31, 1957

SECTION MEETINGS—8:30 A.M.-10:45 A.M.

Members are invited to present a paper on a subject of their choice. Author of the paper should choose the section for his presentation from those listed below and notify the chairman of the section by August 15 if possible. *Speakers will be recognized in the order in which their notices reach the chairman.* Notice should include name, address, and topic.

Papers should not exceed 1,500 words. Maximum time for presentation is 10 minutes.

Papers should be turned in to the chairman at the end of the session. The best paper presented in each section will be printed in the *Journal*. The Editorial Board will serve as judges.

RESEARCH SECTIONS

Section I.   FARM MANAGEMENT
                Chairman: H. R. Stucky, New Mexico A & M College
Section II.   MARKETING
                Chairman: M. D. Woodin, Louisiana State University
Section III.   AGRICULTURAL POLICY
                Chairman: Harry M. Love, Virginia Polytechnic Institute
Section IV.   FOREIGN TRADE
                Chairman: Levi A. Powell, University of Florida

EXTENSION SECTIONS

Section V.   FARM MANAGEMENT
                Chairman: G. W. Westcott, University of Massachusetts
Section VI.   MARKETING
                Chairman: E. W. Cake, University of Florida

Section VII.   CONSUMER EDUCATION
    Chairman: H. M. Flitcraft, Rutgers University
Section VIII.   PUBLIC AFFAIRS
    Chairman: Riley S. Dougan, Ohio State University

TEACHING SECTION

Section IX.   GRADUATE AND UNDERGRADUATE TRAINING
    Chairman: R. G. Bressler, University of California

ECONOMIC DEVELOPMENT SECTION

Section X.   IN THE UNITED STATES AND FOREIGN COUNTRIES
    Chairman: W. W. Armentrout, West Virginia University

GENERAL SESSION—11:00 A.M.-12:00 M.
    Chairman: H. Brooks James, North Carolina State College
    Address: Ezra Taft Benson, Secretary of Agriculture, United States
    Department of Agriculture